# ANNUAL REPORT FOR 2010

# SMOLT COLLECTION, TRANSPORTATION, AND BYPASS AT LITTLE GOOSE DAM ON THE SNAKE RIVER, WASHINGTON

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## Summary

This report summarizes activities and results associated with the collection, transportation and bypass of migrating juvenile steelhead *Oncorhynchus mykiss*; chinook salmon *Oncorhynchus tschawytscha*; sockeye salmon *Oncorhynchus nerka*; and Coho salmon *Oncorhynchus kisutch* at Little Goose Dam in 2010.

A relatively dry winter was offset by a cool wet spring which produced an unexpected above average late spring runoff during the month of June. During this peak, flows were measured above 90 KCFS from June 3 through June 26. Moderate to heavy debris loading occurred in conjunction with the increased river flows impacting the dam and facility heaviest from June 5 to June 16. During this time frame 80% of fish mortalities occurred as a result of debris loading. As in past years, additional measures were enacted to reduce debris impacts on smolt migration. Spill operations occurred from April 3 though August 31 and this was the second year that the spillway weir, located in spillway one, was used to assist in-river smolt downstream migration.

Fish passing through the powerhouse section were collected into the bypass system. Beginning March 24 and continuing through April 30, fish were bypassed and returned to the river below the dam. Beginning May 1, fish were collected for transportation and release into the Columbia River below Bonneville Dam. Daily barging operations continued though May 28 and alternated day barging occurred from May 30 through August 16. Beginning on August 18 and carrying through to November 1, juvenile fish were transported by truck on alternate-days.

In 2010, an estimated 2,870,791 juvenile salmonids were collected April 1 through October 31. Composition by species was 873,078 yearling Chinook (30.4%), 866,607 sub-yearling Chinook (30.2%), 1,085,304 steelhead (37.8%), 8,885 sockeye (0.3%), and 36,917 Coho (1.3%). An estimate 2,723,402 (94.8%) were transported.

Except for debris impacts, all fish collection and transportation operations were performed without incident in 2010.

## Introduction

Little Goose Lock and Dam (LGO), located at river mile (RM) 70.3, is the third of four hydroelectric dams impounding the lower Snake River. Lower Granite Dam is upstream (RM 107.5) and Lower Monumental (RM 41.60) and Ice Harbor dams (RM 9.7) are downstream from LGO. Little Goose Dam is 2,655 feet long and impounds Lake Bryan, a 10,025 acre reservoir with normal operating elevations ranging from 633-638 feet mean sea level (msl). Lower Monumental Dam impounds the Snake River below LGO, forming Lake Herbert G. West, creating tailwater elevations at LGO ranging from 537-544 feet msl. LGO is comprised of five major components; the powerhouse, navigation lock, earthen embankment, spillway, and adult and juvenile fish passage facilities.

Construction of LGO began in 1963 and was complete by 1970. A juvenile fish facility (JFF) was included in the initial dam construction, but underwent modifications in 1982, and 1984. The current juvenile facility was constructed in the late 1980's and became operational in 1990.

The juvenile fish collection and bypass system at LGO extends from the upstream face of the dam downstream to the JFF and tailwater area. System components include 18 extended length submersible bar screens (ESBS), 18 vertical barrier screens (VBS), 36 gatewell orifices, a collection channel, a dewatering structure, and a corrugated flume/pipe which routes fish from the collection channel to the JFF or tailwater (mid-river outfall release). The JFF consists of a fish separator, routing flumes, tanks, raceways, a sampling and marking laboratory, barge and truck loading facilities, and a passive integrated transponder (PIT) tag detection and diversion system.

The objective of the transport program is to improve survival of out migrating salmonid *Oncorhynchus sp.* smolts resulting in enhanced adult salmon and steelhead returns. To accomplish this objective, juvenile salmon and steelhead *O. mykiss* are collected and transported by barge or truck and released into the Columbia River below Bonneville Dam. Operating parameters are set forth annually in the Fish Passage Plan (FPP).

In 2010, from April 1 to May 1 at 0700 hours all fish were routed through primary bypass except for fish collected for condition sampling. Condition sampling was performed on April 5, 12, 16, 21, 26, and May 1, to inspect fish condition, verify proper operating conditions of the Projects' equipment and facilities, test new equipment and train employees. When condition sampling was performed the facility was switched from primary to secondary bypass.

Fish collection for transport, began on May 1, at 0700 hours and continued until October 31 at 0700 hours. All fish collected at the facility were transported by barge or truck, except those that were bypassed or died in-route (mortalities). Fish were bypassed for several reasons and included; to perform facility maintenance, research, PIT-tag diversion, or for continued growth. All mortalities collected were returned to the river, usually at night, to reduce avian predation.

This report summarizes the operations and data collected from April 1 through October 31, 2010 by the United States Army Corps of Engineers (USACE) and Oregon Department of Fish and Wildlife (ODFW) Smolt Monitoring Program (SMP) and transportation biologists and technicians.

## Facility Modifications

Several modifications was made prior to, during, and after the 2010 season.

1. The bypass outfall flume was reconstructed and relocated. The new outfall was extended an additional 400 feet and constructed of 36" corrugated steel pipe. The extension of the outfall allows bypassed fish to re-enter mid- river in better downstream flow conditions ultimately improving downstream migration.

2. Adult fish collection entrances North Shore Entrance 3 and North Powerhouse Entrance 3 were permanently closed off in February 2011. Both these entrances faced inward perpendicular to tailrace spill bays #1 and #8. The permanent closure consisted of removing the recessed bulkheads and filling the entrances with concrete with a flush finished to match the existing concrete walls. The flush finish removes the recessed rectangular opening thus making safer passage for fish migrating in river through spill bays #1 and 8.

3. Upgrades to ESBS include new control systems for the cleaning brushes. The new controls consist of new proximity switches located on the screen and new PLC's located in the orifice gallery, a switch to change the brush cycle between 2 or 4 hours, an emergency stop switch, and a new touch screen computer interface to control ESBS functions by the dam operator.

4. In March of 2011, all pneumatic hoses and fittings were replaced on all 36 orifice air cylinders and valves.

5. Raceway tail screens were replaced in March of 2011. The new screens are 12.2 mm in width as measured from corner to corner. The old screen was 7.2 mm. The larger opening will allow juvenile lamprey to pass through without getting entangled.

6. A new underwater video camera, new monitor and new DVD recorder was purchased in 2010 to be used in underwater inspections of ESBS and VBS.

7. Pacific States Marine Fisheries Counsel installed a new PLC and Interface controller to operate the PIT-tag and sample gate system. The new components are an upgrade to improve sample and PIT-tag gate system performance.

## River Conditions

River Flows

A dry winter, with snowpack at 53% of average as of March, was redeemed by a cold rainy spring creating high elevation spring snowpack and a later than average runoff for the Snake River Basin. The final 2010 water year was predicted to be about 95% of average for the lower Snake River. Flows for April and May were below the five year average (Table 1). Most of the spring freshet occurred throughout the month of June and into July. Flows during the remainder of the season were similar to the five year average.

Table 1. Comparisons of average monthly flow and spill at Little Goose Dam JFF, 2005-2010.

| Month | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2005-2009 Average |
|---|---|---|---|---|---|---|---|
| | | | Flow (Kcfs) | | | | |
| Apr | 42.32 | 121.27 | 45.40 | 52.67 | 84.50 | 40.28 | 69.23 |
| May | 88.23 | 136.05 | 77.39 | 110.90 | 111.04 | 64.83 | 104.72 |
| Jun | 58.04 | 89.95 | 46.55 | 124.86 | 109.48 | 124.58 | 85.78 |
| Jul | 37.67 | 40.47 | 31.62 | 57.39 | 50.43 | 49.51 | 43.52 |
| Aug | 25.69 | 26.98 | 23.74 | 35.79 | 32.02 | 29.81 | 28.84 |
| Sep | 17.71 | 21.01 | 17.95 | 22.70 | 21.84 | 22.62 | 20.24 |
| Oct | 16.59 | 18.99 | 18.43 | 19.64 | 21.26 | 18.97 | 18.98 |
| | | | Spill (Kcfs) | | | | |
| Apr | 0.00 | 29.86 | 13.26 | 13.26 | 24.48 | 11.41 | 16.17 |
| May | 3.30 | 40.92 | 23.39 | 23.39 | 31.13 | 19.40 | 24.43 |
| Jun | 11.41 | 27.98 | 13.98 | 13.98 | 30.88 | 40.91 | 19.65 |
| Jul | 15.53 | 12.49 | 9.50 | 9.50 | 15.09 | 14.83 | 12.42 |
| Aug | 9.92 | 8.58 | 8.54 | 8.54 | 10.11 | 9.40 | 9.14 |
| Sep | 0.16 | 0.18 | 0.34 | 0.34 | 0.20 | 0.18 | 0.24 |
| Oct | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

During the 2010 season, April 2 through October 31, average daily flow past LGO was 50.0 kcfs with a peak daily flow of 199.3 kcfs on June 6 and a minimum daily flow of 12.6 kcfs on October 17 (Figure 1). The major components of total flow at LGO were discharge through turbine units (powerhouse flow) and discharge over spillways. Minor sources of discharge were the fish passage structures and the navigation lock.

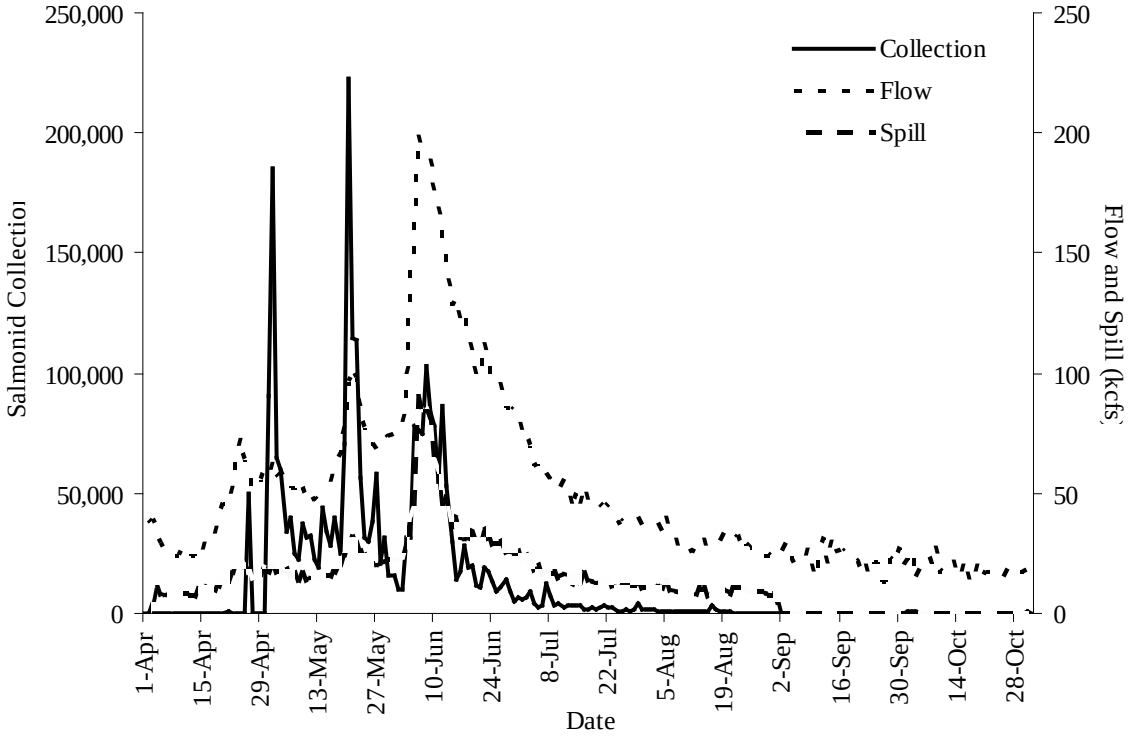


Figure 1. Total river flow, spill, and number of juvenile salmonids collected at Little Goose Dam during the fish collection and transport season, 2010.

Flow augmentation of approximately 10 kcfs from Dworshak Reservoir to aid smolt out migration, occurred from May 19 through May 21. Collection numbers peaked during this interval with the season high of 222,600 smolts arriving at LGO on May 20. Flow augmentation from the Boise and Payette reservoirs occurred through August. Augmentation for temperature control averaged 10.2 kcfs from Dworshak Reservoir for the months of July and August (PNW water supply; Bureau of Reclamation, Columbia River Dart, 2010 Water Management Plan, Fish Passage Center).

Spill designed to improve fish passage and survival rates occurred from April 3 to August 31, 2010, in accordance with the 2010 Fish Passage Plan (FPP). The 2010 FPP specified that spill at Little Goose was to be kept at a constant 30% of outflow. Other factors that affected spill management were high and low runoff conditions, total dissolved gas (TDG) levels, generation unit outages that reduce powerhouse discharges, low power demand, research, and adult fish passage. Changes to spill as a result of these factors were coordinated through the Technical Management Team (TMT). The daily average percentage of discharge from spring and summer spill was 30.2%.

Temperature

River water temperature readings were taken at approximately 0700 hours from April 2 through October 31 in the JFF sample system using a hand-held thermometer. The average daily temperature was 59.2°F. Due to cool spring and mild summer weather, average monthly water temperatures were lower than the five year average for the months of May through October. In June and July water temperatures averaged 3.5 and 3.0°F degrees below the five year average of 59.4 and 68.3°F, respectively, for those months. The maximum temperature of 69.1°F was recorded on August 14 and was below the five year maximum average of 70.7°F. The minimum temperature of 46.1°F was recorded on April 4 and was above the five year average minimum of 45.3°F. Maximum temperatures recorded from 2006 through 2010 occurred on July 11, July 10, August 16, July 29, and August 14, respectively. Minimum temperatures for the same time period were all recorded during the first week of April. As per the Water Management Plan, river temperatures were tempered by scheduled water releases from Dworshak Dam Reservoir, which averaged 10.2 kcfs daily for the months of July and August. Dworshak tailrace temperatures averaged 45.3° F during that period, holding Snake River temperatures to an average of 66.3 ° F for the same interval (Columbia River Dart).

Total Dissolved Gas

Total Dissolved Gas measurements were automatically collected and transmitted to the Columbia River Operational and Hydromet Management System (CROHMS) hourly to provide information for spill and gas saturation management. The USACE Reservoir Control Center (RCC) coordinates efforts to maintain dissolved gas saturation levels in accordance with the Washington State TDG Level Variance Standard of 120% saturation in the project tailwater or 115 % in the forebay of the next project downstream as measured over 12 consecutive hours.

In accordance with the 2010 FPP, TDG was monitored in the forebay from April 1– August 31, and in the tailwater year around. The daily average TDG level in the Little Goose forebay was 109.3% saturation, ranging from 99.0 % saturation on April 9 to 125.6% on June 9. TDG levels at LGO exceeded 115.0% of normal saturation in the forebay from June 6 through June 16 with an average forebay level during that interval of 121.3%. The daily average TDG level in the tailrace was 111.4% during spring and summer spill operations with a high of 126.5% recorded on June 08. TDG levels exceed 120% in the tailrace from June 5 through June 10 averaging 124.8% during that interval. Forebay levels at Lower Monumental Dam during the 2010 spill season averaged 110.0 % with a high of 128.1% on June 9, and a low of 99.7% on April 7. The 115% saturation limit in Lower Monumental Dam forebay was exceeded on May 17 and 18 averaging 116.0% and from June 6 through June 16 averaging 122.8% (Columbia River Dart).

Turbidity

Turbidity was measured during all adult fish passage facility inspections. Measurements were taken in the adult fish ladder using a secchi disk that could be lowered to a maximum depth

of just over 6 feet. The fish ladder water supply is gravity fed from the forebay and was representative of river conditions. During the months of April and May, river flows were low due to cool temperatures. Secchi disk readings during that time ranged from 3.8-6.0 feet. During spring runoff from June 4 through July 5, turbidity increased with secchi disk readings ranging from 0.8 feet to 3.8 feet. Turbidity decreased again as total flow declined, with secchi disk readings ranging from 3.8 to 6 feet from July 5 through November 6.

## Fish Collection

### Migration and Collection

In 2010, ESBS/VBS were lowered into operating position beginning on March 22 and ending on April 5. The juvenile fish passage channel was watered up on March 24 and the system was placed in primary bypass mode. Primary bypass operations occurred through out most of April except for fish condition sampling. Condition sampling occurred for 24 hour intervals (0700 to 0700 hours) on April 4/5, 11/12, 25/26 and April 30/May 1. During the 24 hour condition sampling, the facility was placed in secondary bypass and all fish except those routed to the sample were bypassed through the facility on their own volition. On April 15 and April 20 the facility was switched from primary bypass to secondary bypass from 0700 to 1500 to allow for abbreviated condition sampling in conjunction with gas bubble trauma disease monitoring. PIT tagged fish that passed during secondary bypass operations were interrogated and routed according to their agency PIT tag action code.

A total of 1,335 fish were collected during condition sampling on April 5, 12, 16, 21, and 26. Of this total 1,325 fish were examined and released back to the river to continue their migration, and 10 were facility mortalities. The condition sample conducted May 1 consisted of 233 fish, of which 224 were barged on May 2 and the remaining nine were mortalities, Table 2.

Condition sampling allowed the biologist(s) to review fish condition, estimate fish numbers, verify proper operating conditions of the Projects' equipment and facilities, perform tests to new equipment and train employees. Beginning May 1, at 0700 hours collection for transport began.

The 2010 collection total was the second lowest in recent years. An estimated total of 2,870,791 juvenile steelhead and salmon were collected. This includes fish estimates from condition sampling conducted in April. Composition by species and clip type was: clipped yearling Chinook *O. Tshawytscha* 22.4%, unclipped yearling Chinook 8.0%, clipped sub-yearling Chinook 10.0%, unclipped sub-yearling Chinook 20.2%, clipped steelhead 28.1%, unclipped steelhead 9.7%, clipped sockeye *O. nerka* <0.1%, unclipped sockeye 0.3%, and Coho *O. kisutch* 1.3%. Table 2 compares annual collection, bypass, and transportation of smolts at LGO since 2006.

Table 2. Annual collection, bypass, and transport activity at Little Goose Dam JFF, 2006-2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Total |
| **Collection[1]** | | | | | | | | | | |
| 2006 | 2,423,566 | 697,237 | 352,959 | 415,990 | 2,474,544 | 738,229 | 19,095 | 43,927 | 88,084 | 7,253,631 |
| 2007 | 380,582 | 63,794 | 70,036 | 234,789 | 984,495 | 313,402 | 9,533 | 2,453 | 39,867 | 2,098,951 |
| 2008 | 1,394,415 | 312,097 | 288,424 | 464,630 | 1,807,231 | 501,014 | 17,036 | 4,921 | 95,874 | 4,885,642 |
| 2009 | 1,315,352 | 404,911 | 333,313 | 519,124 | 1,935,602 | 582,074 | 19,992 | 13,678 | 59,544 | 5,183,590 |
| 2010 | 643,811 | 229,267 | 287,702 | 578,905 | 807,812 | 277,492 | 1,291 | 7,594 | 36,917 | 2,870,791 |
| **Bypass[2]** | | | | | | | | | | |
| 2006 | 180,075 | 187,924 | 1,494 | 6,804 | 440,829 | 136,813 | 0 | 8,678 | 1,524 | 964,141 |
| 2007 | 40,052 | 5,946 | 1,250 | 4,630 | 75,659 | 22.213 | 0 | 413 | 365 | 150,528 |
| 2008 | 299,945 | 88,906 | 2,783 | 2,633 | 634,902 | 82,649 | 41 | 31 | 2,764 | 1,114,654 |
| 2009 | 531,880 | 220,143 | 2,181 | 7,125 | 1,160,734 | 299,337 | 1 | 5,825 | 2,825 | 2,230,051 |
| 2010 | 57,991 | 23,242 | 3 | 325 | 46,459 | 12,699 | 0 | 0 | 0 | 140,719 |
| **Truck** | | | | | | | | | | |
| 2006 | 0 | 4 | 145 | 1,727 | 6 | 1 | 0 | 19 | 3 | 1,905 |
| 2007 | 2 | 5 | 72 | 905 | 1,216 | 410 | 0 | 2 | 46 | 2,658 |
| 2008 | 0 | 12 | 153 | 17,403 | 5 | 7 | 0 | 125 | 18 | 17,723 |
| 2009 | 0 | 2 | 123 | 2,753 | 3 | 4 | 1 | 18 | 300 | 3,204 |
| 2010 | 11 | 15 | 79 | 10,514 | 7 | 11 | 1 | 10 | 19 | 10,667 |
| **Barge** | | | | | | | | | | |
| 2006 | 2,239,330 | 507,567 | 349,823 | 405,743 | 2,033,144 | 601,224 | 18,816 | 34,175 | 86,462 | 6,276,284 |
| 2007 | 340,431 | 57,783 | 68,637 | 228,966 | 907,101 | 290,546 | 9,523 | 2,030 | 39,430 | 1,944,447 |
| 2008 | 1,091,599 | 222,556 | 284,812 | 443,255 | 1,171,970 | 418,242 | 16,981 | 4,736 | 93,078 | 3,747,238 |
| 2009 | 782,309 | 184,253 | 328,223 | 505,507 | 774,611 | 282,643 | 19,975 | 7,793 | 56,372 | 2,941,686 |
| 2010 | 585,585 | 205,930 | 285,364 | 564,199 | 761,183 | 264,706 | 1,289 | 7,583 | 36,896 | 2,712,735 |
| **Total Transport** | | | | | | | | | | |
| 2006 | 2,239,330 | 507,571 | 349,968 | 407,470 | 2,033,150 | 601,225 | 18,816 | 34,194 | 86,465 | 6,278,189 |
| 2007 | 340,433 | 57,788 | 68,709 | 229,871 | 908,317 | 290,956 | 9,523 | 2,032 | 39,476 | 1,947,105 |
| 2008 | 1,091,599 | 222,568 | 284,965 | 460,658 | 1,171,975 | 418,249 | 16,981 | 4,861 | 93,105 | 3,764,961 |
| 2009 | 782,309 | 184,255 | 328,346 | 508,260 | 774,614 | 282,647 | 19,976 | 7,811 | 56,672 | 2,944,890 |
| 2010 | 585,596 | 205,945 | 285,443 | 574,713 | 761,190 | 264,717 | 1,290 | 7,593 | 36,915 | 2,723,402 |

[1] Collection counts 2006 through 2008 do not include fish sampled prior to collection for transport.

[2] Bypass counts include fish collected as take by researchers and do not include, NOAA sort by code PIT tagged salmon or Divert During Sample PIT tagged salmon.

Collection for transport by barge began May 1, at 0700 hours and ended August 16, at 0700 hours. A total of 2,718,936 smolts were collected during this time. Of these fish, 2,712,735 (99.8%) fish were transported by barge, 68 (Chinook fry) were bypassed for continued growth and 6,357 were mortalities (Appendix 1). Collection for truck transportation began on August 16 at 0700 hours and ended at 0700 on October 31. A total of 11,224 fish were collected of which 10,667 were transported by truck, 297 were facility mortalities, and 260 were bypassed.

The maximum daily collection of 222,600 smolts occurred on May 20, representing 8.2% of the total collection for the season. This date was later than in previous years and coincided with the release of water from Dworshak Reservoir to assist juvenile fish migration, with flows increasing from 74.3 kcfs on May 19 to 96.4 kcfs on May 20. The peak collection dates for Chinook salmon, Coho, and unclipped sockeye were similar to recent years. The peak collection dates for steelhead and clipped sockeye were later than observed in recent years (Table 3).

Table 3. Annual peak salmonid collection days and count by species group and season at Little Goose Dam JFF, 2006-2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Season |
| 2006 | May 4 (236,480) | April 26 (37,925) | May 30 (20,607) | June 6 (30,026) | May 4 (218,408) | May 4 (66,401) | May 21 (2,800) | May 22 (3,349) | May 22 (11,215) | May 4 (563,357) |
| 2007 | May 15 (69,242) | May 22 (8,062) | June 10 (8,386) | June 10 (30,792) | May 15 (215,853) | May 15 (54,418) | May 18 (2,000) | May 12 (500) | May 15 (7,400) | May 15 (354,332) |
| 2008 | May 12 (104,404) | May 11 (17,002) | June20 (15,873) | June 25 (18,228) | May 11 (156,008) | May 11 (17,002) | May 23 (2,400) | May 26 (700) | May 22 (13,800) | May 11 (309,619) |
| 2009 | May 23 (65,408) | April 28 (23,601) | June 4 (25,720) | June 4 (37,214) | April 27 (180,448) | April 26 (57,600) | May 20, 23 (3,200) | May 7, 8, 23 (1,000) | May 23 (7,800) | April 27 (288,500) |
| 2010 | May 20 (71,700) | May 2 (21,200) | June 12 (33,456) | June 12 (46,507) | May 20 (96,600) | May 20 (29,800) | May 29 (300) | May 20 (2,200) | May 20 (4,000) | May 20 (222,600) |

Adult Fallbacks

Fallbacks are adult salmonids that have passed up stream of the dam and have entered the juvenile collection and bypass system. These adult sized fish were usually too large to pass between the separator bars. Fallback adults were identified by species and fin clip and assessed for condition prior to being released to the river.

A total of 5,426 adult fallbacks were removed from the sample or separator in 2010 (Table 4). Composition by species and clip type included 568 clipped and 408 unclipped adult Chinook salmon, 408 clipped and 372 unclipped jack or mini jack Chinook salmon, 1,755 clipped and 1,884 unclipped steelhead, 15 clipped and 7 unclipped sockeye, and 9 Coho. Many of the steelhead observed in April, May, and June were kelts. Of the 5,426 total fallbacks, 7 clipped and 2 unclipped mini-jacks occurred in the SMP sample after August 9. Mini-jacks are maturing salmon with a fork length of less than 300 mm.

In general, increases and decreases of salmon fallbacks occur in relation to upstream migration time periods. As table 5 indicates, this is evident with Chinook, Sockeye, Coho and fall run steelhead. Adult Chinook fallbacks were greatest in September/October. Steelhead kelts that volitionally out-migrate after spring spawning increase the number of fallbacks in the months of May and June.

Table 4. Total annual adult salmonid fallbacks at Little Goose Dam JFF, 2006-2010.

| Year | Adult Chinook | Jack Chinook | Clip Steelhead | Unclip Steelhead | Sockeye | Coho | Total |
|---|---|---|---|---|---|---|---|
| 2006 | 365 | 512 | 2,715 | 2,408 | 0 | 16 | 6,016 |
| 2007 | 358 | 277 | 1,348 | 839 | 3 | 5 | 2,830 |
| 2008 | 773 | 2,845 | 2,122 | 1,932 | 24 | 16 | 7,712 |
| 2009 | 1,192 | 1,372 | 2,997 | 2,131 | 11 | 35 | 7,738 |
| 2010 | 976 | 780 | 1,755 | 1,884 | 22 | 9 | 5,426 |

*Corrections were made to 2006 data.

Of the steelhead fallbacks in April through June, the majority, 96.3%, were classified as kelts (post spawn). Because kelts are often observed to be in less than optimal condition, steelhead during this time period made up the majority of fish in the fair, poor and dead condition categories. Table 6 lists the numbers of fish by species and condition categories.

Table 5. Monthly totals of fallbacks bypassed at Little Goose Dam, 2010.

| Month | Adult Chinook | Jack Chinook | Clip Steelhead | Unclip Steelhead | Sockeye | Coho | Total |
|---|---|---|---|---|---|---|---|
| April | 1 | 0 | 22 | 42 | 0 | 0 | 65 |
| May | 77 | 5 | 690 | 913 | 0 | 2 | 1,687 |
| June | 197 | 12 | 145 | 560 | 1 | 0 | 915 |
| July | 49 | 15 | 47 | 32 | 18 | 1 | 162 |
| August | 10 | 6 | 173 | 110 | 0 | 0 | 299 |
| September | 185 | 185 | 371 | 98 | 0 | 2 | 841 |
| October | 457 | 557 | 307 | 129 | 3 | 4 | 1,457 |
| Total | 976 | 780 | 1,755 | 1,884 | 22 | 9 | 5,426 |

The majority of the steelhead observed in April, May, and June were kelts.

In addition to adult salmon and steelhead, there were 11 white sturgeon, 9 bull trout, 10 adult Lamprey and numerous other adult incidental fish removed from the separator or sample. All fallback fish were released to the river.

Table 6. Condition of adult salmonids released at Little Goose Dam, 2010.

| Fish Condition[1] | Chinook | | Chinook Jack | | Steelhead | | Sockeye | | Coho | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | |
| Good | 524 | 378 | 393 | 364 | 1,443 | 1,258 | 12 | 5 | 9 | 4,386 |
| Fair | 34 | 21 | 12 | 8 | 212 | 407 | 3 | 1 | 0 | 698 |
| Poor | 9 | 7 | 3 | 0 | 79 | 184 | 0 | 1 | 0 | 283 |
| Dead | 1 | 2 | 0 | 0 | 21 | 35 | 0 | 0 | 0 | 59 |
| Total | 568 | 408 | 408 | 372 | 1,755 | 1,884 | 15 | 7 | 9 | 5,426 |

1 Condition ratings for live fish were determined subjectively based on the presence/absence and severity of fungus, headburns, fin wear, and other injuries.

Note: Table 6 does not separate post spawned "kelt" steelhead from pre-spawned healthier steelhead.

## Separator Efficiency

Separator efficiency is a measure of how effectively fish are separated by size. Due to the spacing of the sorter bars, smaller fish, primarily salmon smolts, should pass through the "A" side and larger fish, primarily steelhead, should pass through "B" side of the separator into the respective sample tanks. Table 7 gives efficiency, expressed as the percentage of each group passing through the desired side of the separator for 2006-2010. Efficiency rates are based on expanded sample counts.

In 2010, separator efficiency was highest for clipped steelhead with 87.8% entering the B-side sample tank (Table 7). Separator efficiency was lowest for clipped sockeye salmon at 12.8% entering the A-side sample tank. In 2010, 44.7% of all salmonid species passed through the A-side, compared to 38.2% in 2009, 36.2% in 2008, 26.0% in 2007, and 44.6% in 2006. Efficiency rates in 2010 were higher than previous years for all yearling Chinook and fell within the range observed in recent years for all other salmonids species.

Table 7. Annual juvenile salmonid separator efficiency (%) at Little Goose Dam JFF, 2006-2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Coho | | Sockeye | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip |
| Year | A-side | A-side | A-side | A-side | B-side | B-side | A-side | A-side | A-side | A-side |
| 2006 | 69.0 | 65.9 | 66.2 | 66.2 | 88.7 | 66.9 | 53.3 | 60.3 | 46.5 | 34.4 |
| 2007 | 63.1 | 61.0 | 52.7 | 55.4 | 95.2 | 87.6 | 26.1 | 27.1 | 22.9 | 61.9 |
| 2008 | 62.7 | 53.7 | 50.0 | 47.9 | 89.8 | 74.0 | ----- | 38.6 | 52.0 | 30.9 |
| 2009 | 66.0 | 61.7 | 52.4 | 52.3 | 89.8 | 68.0 | 21.0 | 26.5 | 19.9 | 20.8 |
| 2010 | 69.8 | 68.3 | 57.4 | 54.8 | 87.8 | 69.4 | 15.1 | 28.0 | 12.8 | 43.1 |

Note: Counts do not include sample mortalities.

## Sampling

The fish sampling system was operated without incident throughout the 2010 season. Sampling procedures followed the smolt monitoring guidelines developed by the Fish Passage Center and the USACE. Data, collected and recorded daily by ODFW and USACE biologists, were used for management of facility and fish transport operations in compliance with 2010 Fish Passage Plan. Data were also transmitted daily to the FPC electronic database in support of the SMP. Prior to transport, sampling occurred on April 5, 12, 16, 21, 26 and May 1. Collection for transport with daily sampling began at 0700 hours May 1 and ended at 0700 hours on October 31. Sample collection rates were set by USACE project biologists. In an attempt to keep the total number of smolts sampled between 400-800 fish, sample rates were varied between 0.25% and 100% as fish numbers fluctuated. Occasional increases or decreases in fish densities required the hourly sample rate to be changed during the 24 hour collection period (split samples). Split sampling occurred 26 times during the season, between April 26 and October 3. The total number of smolts sampled (57,605) was 2.1% of the estimated total juvenile salmonid collection from May 2 through October 31, 2010 (Tables 8 and 9).

Table 8. Annual percentage of total juvenile salmonids collected that were sampled at Little Goose Dam JFF, 2006-2010[1].

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Total |
| 2006 | 0.5 | 0.7 | 3.2 | 5.9 | 0.5 | 0.6 | 0.7 | 0.9 | 0.9 | 1.0 |
| 2007 | 1.9 | 4.7 | 8.4 | 9.7 | 1.8 | 2.3 | 1.6 | 2.8 | 2.3 | 3.1 |
| 2008 | 0.7 | 0.8 | 3.6 | 9.3 | 0.5 | 0.7 | 1.0 | 4.0 | 0.6 | 1.7 |
| 2009 | 0.7 | 0.8 | 2.7 | 6.3 | 0.5 | 0.7 | 19.9 | 20.8 | 2.5 | 1.4 |
| 2010 | 0.9 | 1.0 | 1.7 | 6.3 | 0.8 | 0.9 | 1.9 | 1.1 | 0.9 | 2.1 |

[1]Fish examined for GBT are not included. All other research fish and sample mortality are included in percentages.

All sample fish were examined to determine species, clip type, and the presence of marks or tags. For Chinook salmon, age class was also determined as subyearling, yearling, holdover or adult. All yearling Chinook salmon smolts in the sample were examined for holdover fall Chinook salmon characteristics. All holdover fall Chinook smolts were examined for coded wire tags, PIT tags, and elastomer tags. Beginning in 2010, all unclipped yearling and subyearling Chinook, Coho, and sockeye salmon were scanned for coded wire tags. Yearling fall Chinook salmon were examined for characteristics typical of Lyons Ferry Hatchery fish.

Fish condition data were collected daily on a random subsample of 100 fish of the dominant species. Condition metrics included weight, length, descaling, injury, disease, predation, and "other" monitored conditions; specifically fin discoloration, pop eyes, fin hemorrhage, eye hemorrhage, and pink fin. In 2010, injury and descaling data were used by managers to assess the potential effects of passage at the dam. Old injuries, injuries not likely to have occurred at LGO, were not recorded during condition sampling. Also in 2010 all additional "non-condition" sample fish were examined for descaling greater than 20%.

Pound counts (fish per pound) taken during condition sampling were calculated on a daily basis from May 2 to October 31. On transportation days, weights were also taken on non-condition salmonids if the target number of 25 per group were not present in the condition sample. Pound counts were also taken on all non-salmonid species on transportation dates from May 2 until August 19. After August 19, the sample rate was set at 100% and all non-salmonid species were removed from the sample prior to transport.

A total of 57,604 juvenile salmonids were sampled during the season from April 1 through October 31. This total included sample mortality, research fish, and fish examined for GBT (Table 9). From August 19 to October 31, 100% of the collection was sampled, except for October 3 when the sample rate was dropped to 10% from 0300-0700 hours due to a large influx of subyearling fall Chinook.

Table 9. Weekly sample in percent of collection and sample totals at Little Goose Dam JFF, 2010.

| Week Ending | Weekly % Sampled (%) | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | Totals[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | |
| 1-Apr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8-Apr | 100.0 | 0 | 5 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 11 |
| 15-Apr | 100.0 | 26 | 9 | 0 | 0 | 91 | 95 | 0 | 0 | 0 | 221 |
| 22-Apr | 100.0 | 123 | 20 | 0 | 0 | 260 | 55 | 0 | 0 | 0 | 458 |
| 29-Apr | 1.3 | 137 | 81 | 0 | 0 | 342 | 82 | 0 | 0 | 0 | 642 |
| 6-May | 0.4 | 766 | 220 | 0 | 0 | 666 | 164 | 0 | 0 | 5 | 1,821 |
| 13-May | 1.6 | 1,519 | 307 | 0 | 1 | 856 | 273 | 0 | 0 | 22 | 2,978 |
| 20-May | 0.8 | 1,743 | 409 | 0 | 0 | 976 | 329 | 0 | 12 | 50 | 3,519 |
| 27-May | 0.6 | 629 | 326 | 9 | 25 | 1,125 | 528 | 0 | 12 | 56 | 2,710 |
| 3-Jun | 1.7 | 358 | 441 | 151 | 265 | 637 | 350 | 20 | 25 | 89 | 2,336 |
| 10-Jun | 0.5 | 106 | 145 | 526 | 889 | 540 | 208 | 1 | 3 | 45 | 2,463 |
| 17-Jun | 1.1 | 43 | 68 | 1,093 | 1,487 | 145 | 135 | 2 | 4 | 15 | 2,992 |
| 24-Jun | 3.2 | 14 | 28 | 1,053 | 2,274 | 95 | 104 | 1 | 1 | 12 | 3,582 |
| 1-Jul | 5.2 | 7 | 6 | 847 | 2,167 | 47 | 66 | 0 | 2 | 9 | 3,151 |
| 8-Jul | 9.6 | 6 | 6 | 579 | 3,755 | 32 | 41 | 0 | 5 | 10 | 4,434 |
| 15-Jul | 12.8 | 0 | 1 | 175 | 2,846 | 7 | 8 | 0 | 5 | 2 | 3,044 |
| 22-Jul | 20.4 | 2 | 2 | 117 | 3,298 | 4 | 8 | 0 | 2 | 0 | 3,433 |
| 29-Jul | 25.0 | 1 | 2 | 37 | 3,131 | 6 | 4 | 0 | 0 | 6 | 3,187 |
| 5-Aug | 29.9 | 1 | 0 | 27 | 2,563 | 0 | 2 | 0 | 1 | 2 | 2,596 |
| 12-Aug | 50.1 | 9 | 0 | 42 | 2,554 | 2 | 4 | 0 | 1 | 0 | 2,612 |
| 19-Aug | 35.5 | 2 | 0 | 18 | 3,193 | 2 | 5 | 0 | 0 | 1 | 3,221 |
| 26-Aug | 99.9 | 5 | 1 | 8 | 1,648 | 0 | 2 | 0 | 0 | 3 | 1,667 |
| 2-Sep | 100.0 | 1 | 1 | 6 | 514 | 0 | 1 | 0 | 2 | 3 | 528 |
| 9-Sep | 100.0 | 0 | 0 | 2 | 147 | 2 | 1 | 0 | 2 | 2 | 156 |
| 16-Sep | 100.0 | 2 | 0 | 1 | 136 | 1 | 1 | 0 | 0 | 1 | 142 |
| 23-Sep | 100.0 | 1 | 0 | 2 | 109 | 0 | 1 | 0 | 2 | 1 | 116 |
| 30-Sep | 100.0 | 0 | 0 | 3 | 133 | 0 | 0 | 0 | 0 | 1 | 137 |
| 7-Oct | 87.6 | 1 | 1 | 28 | 2,183 | 0 | 1 | 0 | 2 | 1 | 2,217 |
| 14-Oct | 99.8 | 0 | 0 | 7 | 645 | 0 | 0 | 1 | 0 | 1 | 654 |
| 21-Oct | 99.1 | 2 | 0 | 5 | 521 | 0 | 0 | 0 | 0 | 0 | 528 |
| 28-Oct | 99.5 | 0 | 1 | 8 | 1,060 | 0 | 2 | 0 | 0 | 0 | 1,071 |
| 4-Nov | 99.0 | 0 | 2 | 4 | 967 | 0 | 0 | 0 | 2 | 2 | 977 |
| Total Sampled | | 5,504 | 2,082 | 4,748 | 36,511 | 5,839 | 2,473 | 25 | 83 | 339 | 57,604 |
| % of Sample | | 9.6 | 3.6 | 8.2 | 63.4 | 10.1 | 4.3 | <0.1 | 0.1 | 0.6 | 100.0 |
| % of Coll. | | 0.9 | 0.9 | 1.7 | 6.3 | 0.7 | 0.9 | 1.9 | 1.0 | 0.9 | 2.0 |

[1]All research fish, GBT fish and sample mortality included in species group/clip type numbers.

Note: Little Goose JFF was in primary bypass mode, going to secondary bypass for limited condition sampling on April 5, 12, 16, 21, 26, and May 1. Collection for transport with daily 24 hour sampling began on May 1 at 0700 hours and ended October 31 at 0700 hours.

The composition, by species and clip type, of smolts sampled in 2010 was: clipped yearling Chinook 9.6%, unclipped yearling Chinook 3.6%, clipped sub-yearling Chinook 8.2%, unclipped sub-yearling Chinook 63.4%, clipped steelhead 10.1%, unclipped steelhead 4.3 %, clipped sockeye <1%, unclipped sockeye 0.1%, and clipped and unclipped Coho combined 0.6% (Table 9).

In 2010, fall Chinook were bypassed from the sample by ODFW to USGS for research during the month of October. Approved permits, collection criteria, and a schedule of collection numbers were provided to Corp biologists for authorization prior to collection. In 2010, sample rates were not varied in order to increase collection to provide fish for research projects.

Transportation

Juvenile salmonids collected for transport by barge were held in raceways or directly loaded into barges. Juveniles awaiting transportation by truck were held in tanks or loaded directly into the transport truck. Maximum fish holding time prior to transport varied from 3 hours to 48 hours depending on the transportation schedule. Transport time from Little Goose to the approved release point was approximately 2 days by barge or 6 hours by truck. Fish that were transported by truck were transported in a mild saline solution of 1mg/L to reduce stress and treat columnaris disease. In 2010, daily barging and direct loading operations occurred from May 2 to May 28, alternate day barging occurred from May 30 to August 16 and alternate day trucking occurred from August 18 to October 31. There were no incidents which resulted in transportation related mortalities during the 2010 season.

A total of 2,723,402 juvenile salmonids were transported from Little Goose in 2010, 99.6% by barge and 0.4% by truck/midi tank (Table 2). Salmonids transported by truck in 2010 were primarily, 98.6%, unclipped subyearling Chinook salmon.

Bypass

In 2010 primary bypass began on March 23 and ended when collection for barge transportation began on May 1 at 0700 hours. There is no estimate of the number of fish that passed while the facility was in primary bypass mode. The facility was placed in secondary bypass for 24 hour sampling from 0700 hours to 0700 hours on April 4/5, 11/12, 25/26, and April 30/May 1. Abbreviated sampling occurred from 0700 until 1500 hours on April 15 and 20 to collect sample fish for SMP condition monitoring, and for WDFW GBT sampling.

Bypass totals during collection for transportation from May 1 at 0700 hours until October 31 at 0700 hours included 328 smolts, 260 of which were given to researchers from the USGS. The remaining 68 were salmonid fry under 60 mm in fork length which were bypassed back to the river for continued growth. All fish given to research were considered “bypassed” although they were not released directly to the river from the LGO JFF.

The facility was also placed into primary bypass on one occasion in 2010 for separator debris removal. This occurred on June 30 from 1400-1500 hours. During this time an unknown number of fish were bypassed back to the river. In addition, approximately 200 ammocoete lamprey were salvaged from the debris and returned to the river.

Pit Tag Detections

The passive integrated transponder (PIT) tag detection system records data on PIT tagged salmonids as they pass through the juvenile collection system. In 2009 four new full flow pit tag detectors were installed in the juvenile collection flume. The PTAGIS database categorized all PIT tag detections based upon species, race, clip type/rearing disposition. An additional "orphan" category was used for detections of PIT tags for which the database contained no record of tagging and release. Data were categorized, based on exit monitor detections, as exiting 1) to the river, 2) to transport holding areas, 3) to the smolt monitoring subsample, and 4) unknown. This last category included final detections of PIT tagged fish at locations that did not constitute an exit.

Beginning April 1 and ending October 31 a total of 171,029 PIT tagged salmonids were detected within the juvenile collection/bypass system; 119,536 Chinook salmon, 530 Coho salmon, 48,954 steelhead, 1,587 sockeye salmon and 422 orphans. Of this total, 22,969 PIT tag detections were recorded with unknown distribution; 12,015 Chinook salmon, 10,849 steelhead, 5 sockeye, 18 Coho, and 82 orphans. Detections of PIT tagged fish at exits leading to transport areas totaled 56,120 smolts; 38,170 Chinook salmon, 17,520 steelhead, 24 sockeye, 389 Coho, and 17 orphans. PIT tagged fish detected at river exits totaled 89,539 smolts; 67,217 Chinook, 20,333 steelhead, 118 Coho, 1,549 sockeye, and 322 orphan tags. PIT tagged salmonids recorded entering the smolt monitoring subsample totaled 2,401; 2,134 Chinook salmon, 252 steelhead, 9 sockeye, 5 Coho, and 1 orphan. All PIT tagged live smolts in the subsample were either routed back to the river if the facility was operating in secondary bypass mode, or to a transport holding area when the facility operated in collection mode.

Incidental Species

The total incidental fish collection was determined by expanding the sample count and adding incidental fish released from the separator. The total incidental collection count in 2010 was 163,375 (Tables 10 and 11). Sample and separator incidental species were counted individually except when handling large numbers of juvenile American shad *Alosa sapidissima*, sculpin *Cottidae*, Siberian prawn *Exopalaemon modestus*, juvenile smallmouth bass *Micropterus dolomieui*, and peamouth *Mylocheilus caurinus*. When large numbers of these species occurred in the sample, their numbers were estimated by multiplying their total weight times the average weight per individual based on a 50-100 fish sample. Fry or species with small adult size typically occurred in the sample, while adults of larger species could not fit through the sizing bars and were removed at the separator. All sampled incidental fish were returned to the river. When the sample rate was less than 100%, incidental species were inadvertently collected and barged. Therefore, when sample rates were below 100%, pound counts were calculated and used to determine the weight of incidental fish directed to transport holding tanks and their contribution to transport tank loading densities.

The majority of incidental fish collected and released from the separator in 2010 were American shad 50.1%, sandroller P*ercopsis transmontana* 34.5%, and suckers *Catostomus spp.* 5.2% (Table 10).

Table 10. Collection of incidental species at Little Goose Dam, 2010

| Common Name | Scientific Name | Expanded Sample | Separator | Total Collection[1,2] |
|---|---|---|---|---|
| Pacific lamprey (Adult) | *Lampetra tridentate* | 2 | 9 | 11 |
| Pacific lamprey (Juvenile) | *L. tridentata (Macropthalmia)* | 57,727 | 75 | 57,802 |
| Pacific lamprey (Ammocoete) | *L. tridentate* | 1,650 | 0 | 1,650 |
| White sturgeon | *Acipenser transmontanus* | 0 | 11 | 11 |
| American shad | *Alosa sapidissima* | 13,395 | 5,408 | 18,803 |
| Whitefish | *Prosopium sp.* | 5,594 | 20 | 5,614 |
| Brown trout | *Salmo trutta* | 0 | 0 | 0 |
| Rainbow trout | *Oncorhynchus mykiss* | 99 | 0 | 99 |
| Kokanee | *O. nerka* | 0 | 0 | 0 |
| Bull trout | *Salvelinus confluentus* | 0 | 9 | 9 |
| Common carp | *Cyprinus carpio* | 432 | 290 | 722 |
| Goldfish | *Carassius auratus* | 0 | 1 | 1 |
| Chiselmouth | *Acrocheilus alutaceus* | 3 | 11 | 14 |
| Dace | *Rhinichthys sp.* | 29 | 0 | 29 |
| Northern pikeminnow | *Ptychocheilus oregonensis* | 63 | 10 | 73 |
| Peamouth | *Mylocheilus caurinus* | 5,771 | 286 | 6,057 |
| Sucker | *Catostomus sp.* | 1,263 | 557 | 1,820 |
| Tadpole madtom | *Noturus gyrinus* | 2 | 0 | 2 |
| Channel catfish | *Ictalurus punctatus* | 193 | 176 | 369 |
| Bullhead | *Amierus sp.* | 323 | 0 | 323 |
| Redside Shiner | *Richardsonius balteatus* | 0 | 0 | 0 |
| Sandroller | *Percopsis transmontana* | 20,541 | 3,719 | 24,260 |
| Smallmouth bass | *Micropterus dolomieu* | 4,070 | 80 | 4,150 |
| Largemouth bass | *M. salmoides* | 1 | 2 | 3 |
| Crappie | *Pomoxis sp.* | 233 | 85 | 318 |
| Sunfish[3] | *Lepomis sp.* | 233 | 6 | 239 |
| Walleye | *Stizostedion vitreum* | 1 | 19 | 20 |
| Yellow perch | *Perca flavescens* | 2 | 12 | 14 |
| Sculpin | *Cottus sp.* | 2,062 | 0 | 2,062 |
| Other[4] | ---------- | 218 | 6 | 224 |
| Shrimp | *Exopalaemon modestus* | 38,676 | 0 | 38,676 |
| Total | | 152,583 | 10,792 | 163,375 |

[1]Collection totals estimated by expanding the sample counts, then adding the separator counts.

[2] Numbers include live and dead incidental fish.

[3] Sunfish includes 13 warmouth from the expanded sample.

[4] Other includes 213 Banded Killifish, 3 crayfish, 2 unidentifiable mortalities from the expanded sample.

Juvenile Pacific lamprey *Lampetra tridentata* dominated expanded sample collections in 2010 at 37.8% of the total. Siberian prawn *Exopalaemon modestus* comprised the second most numerous species (25.3%) followed by sandroller (13.5 %). Although expanded sample counts were dominated by juvenile Pacific lamprey this year, Siberian prawn dominated individual sample count observations totaling 24,073 prawn versus 416 lamprey.

For the fifth consecutive year, we observed an increase in collection counts of Siberian prawn. The number of prawn observed and expanded upon from the sample increased substantially compared to previous years, totaling 38,676 prawn in 2010, an increase of 611.3%

from the 6,327 total prawn collected in 2009, 5,207 prawn in 2008, 620 total prawn in 2007 and 327 prawn in 2006. As in 2009, all prawns were observed in the sample and none were documented as releases from the separator. On 24 July 2007, Washington Department of Fish and Wildlife requested that all Siberian prawns encountered in the sample be euthanized and ODFW SMP biologists continued this practice during the 2010 fish passage season.

Table 11. Numbers of incidental species collected at Little Goose Dam JFF, 2006-2010

| Common Name | Scientific Name | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| Pacific lamprey (Adult) | *Lampetra tridentata* | 346 | 64 | 144 | 125 | 11 |
| Pacific lamprey (Juvenile) | *L. tridentata* | 200,302 | 4,568 | 12,532 | 88,415 | 57,802 |
| Pacific lamprey (Ammocoete) | *L. tridentata* | 3,718 | 52 | 1,839 | 5,126 | 1,650 |
| White sturgeon | *Acipenser transmontanus* | 15 | 12 | 10 | 5 | 11 |
| American shad | *Alosa sapidissima* | 18,994 | 15,300 | 69,925 | 25,388 | 18,803 |
| Whitefish | *Prosopium* spp. | 2,116 | 324 | 1,502 | 1,940 | 5,614 |
| Brown trout | *Salmo trutta* | 0 | 0 | 0 | 0 | 0 |
| Rainbow trout | *Oncorhynchus mykiss* | 3 | 34 | 112 | 17 | 99 |
| Kokanee | *O. nerka*, lacustrine type | 56 | 50 | 1 | 14 | 0 |
| Bull trout | *Salvelinus confluentus* | 5 | 2 | 5 | 5 | 9 |
| Common carp | *Cyprinus carpio* | 185 | 20 | 113 | 145 | 722 |
| Goldfish | *Carassius auratus* | 0 | 0 | 0 | 0 | 1 |
| Chiselmouth | *Acrocheilus alutaceus* | 76 | 6 | 13 | 15 | 14 |
| Dace | *Rhinichthys* spp. | 3 | 4 | 12 | 10 | 29 |
| Northern pikeminnow | *Ptychocheilus oregonensis* | 55 | 42 | 61 | 565 | 73 |
| Peamouth | *Mylocheilus caurinus* | 4,787 | 755 | 1,820 | 2,798 | 6,057 |
| Sucker | *Catostomus* spp. | 4,234 | 1,834 | 1,433 | 2,413 | 1,820 |
| Tadpole madtom | *Noturus gyrinus* | 9 | 2 | 3 | 1 | 2 |
| Channel catfish | *Ictalurus punctatus* | 2,549 | 551 | 389 | 618 | 369 |
| Bullhead | *Amierus* spp. | 261 | 57 | 107 | 374 | 323 |
| Redside shiner | *Richardsonius balteatus* | 3 | 2 | 0 | 0 | 0 |
| Sandroller | *Percopsis transmontana* | 2,304 | 1,904 | 3,877 | 4,124 | 24,260 |
| Smallmouth bass | *Micropterus dolomieui* | 14,183 | 1,442 | 15,503 | 5,092 | 4,150 |
| Largemouth bass | *M. salmoides* | 4 | 0 | 7 | 32 | 3 |
| Crappie | *Pomoxis* spp. | 25,824 | 872 | 363 | 1,076 | 318 |
| Sunfish (bluegill, pumpkinseed, warmouth) | *Lepomis sp.* | 1,884 | 513 | 544 | 585 | 239 |
| Walleye | *Stizostedion vitreum* | 16 | 26 | 32 | 19 | 20 |
| Yellow perch | *Perca flavescens* | 79 | 10 | 28 | 46 | 14 |
| Banded Killifish | *Fundulus diaphanous* | 0 | 0 | 13 | 17 | 213 |
| Sculpin | *Cottus* spp. | 579 | 1,075 | 1,126 | 3,733 | 2,062 |
| Other | ---------- | 241 | 48 | 4 | 328 | 11 |
| Shrimp | *Exopalaemon modestus* | 397 | 620 | 5,213 | 6,327 | 38,676 |
| Total | | 283,228 | 30,189 | 116,731 | 149,336 | 163,375 |

Note- Numbers include expanded sample counts and separator releases.

For the second consecutive year, we observed warmouth *Lepomis gulosus* in the sample. A total of 13 fish were collected in 2010. Prior to 2009, warmouth had not been noted in the sample since 2002. Warmouth observations were also recorded in 2000 and 1999. Historically, warmouth may not have been identified to species but may have been documented and reported,

along with other representatives from the Lepomis family, as “sunfish”. Currently, warmouth are listed collectively with sunfish in Tables 10 and 11 with appropriate footnotes.

A total of 213 Banded killifish *Fundulus diaphanous* were collected in 2010, a substantial increase from the 17 killifish collected in 2009 and 13 killifish collected in 2008. Individual sample observations of the banded killifish totaled 19 fish. Killifish sample collections peaked in late June and early July in 2010 but they were observed in the sample as early as April 12 and as late as October 29. Currently, the banded killifish are documented collectively with “other” in Table 10 with appropriate footnotes. However, as the killifish are relatively new to the record, we have listed them separately in Table 11 for intra-year comparisons.

## Fish Condition

Fish condition was monitored daily by SMP biologists and biological aids. “The primary roll of condition monitoring is to identify the proportion of each species of migratory juvenile salmon that are descaled or have significant injuries indicative of problems in fish passage at dams, such as debris in fish bypass apparatus” (FPC program user manual). Condition categories included descaling, injury, disease, predation, weight, length, and an “other” category which included pop eyes, pink fins, fin discoloration, and hemorrhaged fins. Since fish sustain injury during rearing and upon hatchery release, only fresh injuries and descaling were recorded. For example, the presence of a slime coat (healing) over a descaled area would indicate that the descaling was not recent and did not occur during dam passage, and the old descaling would not be noted.

A condition subsample composed of 100 fish of the dominant species, as per the 2010 SMP protocol, was examined daily for condition metrics. Additionally, in 2010 all non-condition sample fish were also examined for descaling. Since both yearling Chinook salmon and steelhead are numerous in the spring migration, a random sample of 100 fish were taken from each A and B sample tanks; which select for the respective dominant species. During summer and fall migration the composition of the sample consisted primarily of subyearling fall Chinook, so the target condition subsample was reduced to 50 of that species from each sample tank, or a target condition sample of 100 total fish. On days that sample numbers were low all fish were examined for condition.

### Descaling

The fish condition sampling protocol calls for descaling, and most injuries, to be recorded only if it likely occurred during passage at LGO. Prior to 2009, all unhealed descaling was reported. In 2009 and 2010, only descaling that was fresh in appearance was reported. Descaling that did not appear to be “fresh” was not noted. As in previous years, a smolt was considered descaled if more than 20% of the scales were missing from either side of the fish. In 2010 descaling data was collected from both the condition and non-condition subsamples. During the condition subsample, several finer gradations of descaling were also noted. Fish with

6-19% of the scales missing from either side of the fish were considered partially descaled. The condition sample data collection system also included a category, called "descaling with predation", and used to designate descaling caused by predation attempts by birds, fish, and "other" animals. The non-condition descaling data entry program did not allow for these distinctions. During non-condition sampling, only descaling greater than 20% was noted, with no distinction made as to cause, and "partial descaling" was not recorded.

A total of 55,486 fish or 2.0% of the total collection and 100% of the total sample were examined for descaling in 2010. Descaling was noted on 0.3% of the smolts examined, a rate lower than was observed from 2006 through 2008 as would be expected given the change in criteria. In 2010 descaling rates were very low with only a combined total of 170 fish noted as descaled within the sample. There were 20,158 fish examined for descaling in the condition sample with 122 fish reported as descaled. Approximately 63.1% of the descaled fish in the condition sample had evidence of predation attempts. There were 35,328 fish examined for descaling in the non-condition sample with 48 fish reported with descaling. There was no distinction made as to cause of descaling in the non-condition sample. It should be noted that in 2009 descaling linked to predation attempts was not included in the total descaling rate, while in 2010 predator descaling was included in the total descaling rate. Minor descaling was not included in descaling rates for either year. All combined descaling is given in Table 12.

Table 12. Annual descaling rates (%) for salmonids examined at Little Goose Dam JFF, 2006-2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Totals |
| 2006 | 2.5 | 1.5 | 1.2 | 1.0 | 2.2 | 1.6 | 2.4 | 4.3 | 1.9 | 1.6 |
| 2007 | 3.2 | 2.6 | 1.6 | 1.2 | 2.4 | 3.2 | 2.0 | 0.0 | 6.1 | 2.2 |
| 2008 | 1.0 | 0.7 | 0.5 | 0.7 | 0.6 | 0.4 | 0.6 | 1.1 | 0.2 | 0.7 |
| 2009 | 0.7 | 0.7 | 0.3 | 0.3 | 0.5 | 0.8 | 0.0 | 0.4 | 0.2 | 0.4 |
| 2010 | 0.5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.0 | 0.0 | 0.6 | 0.3 |

Note: GBT sample numbers not included in descaling rate calculations. Descaling rates include descaling from predation.

The highest descaling rates were observed on combined Coho at 0.6% of 337 fish sampled (50% linked to predation attempts and 50% observed in the non-conditon sample with no distinction made as to cause). The next highest descaling rate was on clipped yearling Chinook with a descaling rate with 0.5% (37.5% linked to passage, 25.0% to predation, and 37.5% unspecified); unclipped yearling Chinook 0.3% descaling (50% linked to passage, 16.7% to predation, and 33% unspecified); clipped subyearling Chinook with 0.3% descaling (28.6% linked to passage, 64.3% to predation, and 7.1% unspecified); unclipped subyearling Chinook with 0.3% descaling (19.6% linked to passage, 49.0% to predation, and 31.4% unspecified); clipped steelhead with 0.3% descaling (38.8% linked to passage, 44.4% to predation, and 16.8% unspecified); unclipped steelhead with 0.2% descaling (50% linked to passage and 50% to predation); clipped and unclipped sockeye, and clipped Coho had the lowest rates of descaling rate with no descaling noted, but these groups also had low sample numbers.

In 2010 the average weekly overall descaling rate ranged from 0.0% to 6.3% (Table 13). The lowest descaling rates were observed during the months of July and August when debris

accumulations were minimal and sample numbers were still between 400-800 fish per day. The highest weekly descaling rate of 6.3% occurred the week ending September 23; with all observed descaling associated with fish bites. Peaks in descaling rates occurred when collection numbers were very low and rates could be strongly influenced by a few individuals and did not correspond to periods of debris accumulation in the forebay. The overall descaling rate during the period of high debris accumulation from June 4 through July 5 was 0.2%. The season average weekly descaling rate for all fish was 0.3%. The median weekly descaling rate for all fish was 0.3%.

Other Injuries and Disease

Injury rates cannot be accurately compared to rates observed in previous years due to the change in injury data collection protocols. The rates reported for 2001-2003 are believed to include minor descaling and body abrasions. However, the change was not well documented and current staff were not on the project at that time. From 2004-2008, minor descaling and abrasions were included in the body injury category until mid-June 2008 when condition sampling was standardized at all SMP sites at hydroelectric dams in the Columbia Basin and minor descaling was no longer included in injury tallies (Table 14). Beginning in 2009, protocols called for injuries to be recorded only if it appeared that the injury could have resulted from passage at LGO. This differs from previous years when injuries were recorded based solely on the presence of an injury and no attempt was made to determine if the injury occurred at LGO or at some time prior to the fish's arrival at the dam.

Injuries were recorded by location on the fish; operculum, eye, body, head, or fin, and included cuts, contusions, scrapes, and abrasions that were fresh in appearance. Disease classifications included body fungus, columnaris, body parasites, deformity, BKD, and a disease "other" category. As in 2009, predation was recorded as a separate category of condition and not included in the "injury" category. The predation category included bite marks from fish, bird, lamprey, and "other" predation. A final category included other conditions that were of unknown origin and included hemorrhaged fin, hemorrhaged eye, pink fin, discolored fin, and pop eye. A summary of 2010 condition data by category is found in table 15.

We examined a total of 20,158 fish for injuries. The overall injury rate for 2010 was low at 0.5% for all species groups combined. Injuries were most frequently observed on the operculum (0.2%), followed by the eye (0.1%), additional injuries noted to the head, fin, and body were <0.1% for each category. The highest rates of injury were reported in unclipped sockeye at 4.8% of 42 examined, clipped steelhead at 1.5% of 2,210 fish examined, and clipped yearling Chinook at 1.1% of 2,075 examined. There were no injuries reported for combined Coho with 134 examined, and clipped sockeye with 12 total examined.

Data on the presence of disease symptoms were collected to provide relative information about fish health. The disease rate was determined from observations of the following categories: columnaris, BKD, deformity, body parasites, body fungus and "other" disease symptoms. The

Table 13. Weekly descaling rates (%) for salmonids examined at Little Goose Dam JFF, 2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Week Ending | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Total[1] |
| 1-Apr | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 8-Apr | ----- | 0.00 | ----- | ----- | 0.00 | 0.00 | ----- | ----- | ----- | 0.00 |
| 15-Apr | 0.00 | 0.00 | ----- | ----- | 0.00 | 0.00 | ----- | ----- | ----- | 0.00 |
| 22-Apr | 2.33 | 8.33 | ----- | ----- | 0.47 | 2.22 | ----- | ----- | ----- | 1.41 |
| 29-Apr | 1.83 | 0.00 | ----- | ----- | 0.33 | 0.00 | ----- | ----- | ----- | 0.56 |
| 6-May | 0.55 | 0.48 | ----- | ----- | 0.65 | 0.63 | | 0.00 | 0.00 | 0.58 |
| 13-May | 0.55 | 0.33 | ----- | ----- | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 |
| 20-May | 0.35 | 0.25 | ----- | ----- | 0.33 | 0.00 | 0.00 | 2.22 | 2.00 | 0.32 |
| 27-May | 0.16 | 0.00 | 0.00 | 0.00 | 0.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 |
| 3-Jun | 0.00 | 0.23 | 0.00 | 0.00 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.09 |
| 10-Jun | 1.01 | 0.79 | 1.17 | 0.00 | 0.79 | 0.00 | 0.00 | 2.44 | 2.22 | 0.56 |
| 17-Jun | 0.00 | 0.00 | 0.37 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 |
| 24-Jun | 0.00 | 0.00 | 0.20 | 0.14 | 1.09 | 1.03 | ----- | 0.00 | 0.00 | 0.20 |
| 1-Jul | 0.00 | 0.00 | 0.12 | 0.05 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 0.07 |
| 8-Jul | 0.00 | 0.00 | 0.18 | 0.03 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 0.05 |
| 15-Jul | ----- | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 0.03 |
| 22-Jul | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | ----- | ----- | ----- | 0.09 |
| 29-Jul | 0.00 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 0.13 |
| 5-Aug | 0.00 | ----- | 0.00 | 0.20 | ----- | 0.00 | ----- | 0.00 | 0.00 | 0.20 |
| 12-Aug | 0.00 | ----- | 0.00 | 0.16 | 0.00 | 0.00 | ----- | ----- | ----- | 0.16 |
| 19-Aug | 0.00 | ----- | 0.00 | 0.06 | 0.00 | 0.00 | ----- | ----- | ----- | 0.06 |
| 26-Aug | 0.00 | 0.00 | 0.00 | 0.18 | ----- | 0.00 | ----- | 0.00 | 0.00 | 0.18 |
| 2-Sep | 0.00 | 0.00 | 0.00 | 0.00 | ----- | 0.00 | ----- | 0.00 | 0.00 | 0.00 |
| 9-Sep | ----- | ----- | 0.00 | 1.42 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 1.33 |
| 16-Sep | 0.00 | ----- | 0.00 | 1.52 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 1.45 |
| 23-Sep | 0.00 | ----- | 0.00 | 6.73 | ----- | 0.00 | ----- | 0.00 | 0.00 | 6.31 |
| 30-Sep | ----- | ----- | 0.00 | 3.05 | ----- | ----- | ----- | ----- | 0.00 | 2.96 |
| 7-Oct | 0.00 | 0.00 | 0.00 | 0.60 | ----- | 0.00 | ----- | 0.00 | 0.00 | 0.59 |
| 14-Oct | ----- | ----- | 0.00 | 0.97 | ----- | ----- | 0.00 | ----- | 0.00 | 0.96 |
| 21-Oct | 0.00 | ----- | 0.00 | 1.83 | ----- | ----- | ----- | ----- | ----- | 1.81 |
| 28-Oct | ----- | 0.00 | 0.00 | 1.65 | ----- | 0.00 | ----- | ----- | ----- | 1.64 |
| 4-Nov | ----- | 0.00 | 0.00 | 0.95 | ----- | ----- | ----- | 0.00 | 0.00 | 0.94 |
| Totals: | | | | | | | | | | |
| Descaled | 24 | 6 | 14 | 102 | 18 | 4 | 0 | 0 | 2 | 170 |
| Examined | 5,242 | 1,980 | 4,625 | 35,408 | 5,436 | 2,351 | 25 | 82 | 337 | 55,486 |
| % Descale | 0.46 | 0.30 | 0.30 | 0.29 | 0.33 | 0.17 | 0.00 | 0.00 | 0.59 | 0.31 |
| Median Weekly Rate | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 |

[1] Descaling figures do not include sample mortalities or fish examined for GBT.
[2] "-----" means species group not present in sample during this week.

overall disease rate was 7.7% from 20,158 fish examined for disease. The most frequently observed disease category was columnaris at 5.8%, the highest percentage of columnaris occurred in unclipped subyearling Chinook at 9.3% from 12,360 examined, followed by clipped sockeye at 8.3% from 12 examined, and subyearling Chinook at 0.8% from 1,581 examined; body parasitism at 0.7%, with the highest percentage observed in unclipped steelhead at 2.7% from 895 examined, and clipped subyearling Chinook at 1.1% from 1,581 examined; body

deformities at 0.7% with the highest percent observed in clipped subyearling fall Chinook at 2.7% from 1,581 examined; body fungus was noted on 0.5% of the condition sample and was highest in unclipped steelhead at 2.2% from 895 examined, followed by clipped steelhead at 1.5% from 2,210 fish examined.

Table 14. Annual body injury rates (%) for salmonids examined at Little Goose Dam Juvenile Fish Facility, 1998-2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Years | Clipped | Unclip | Clipped | Unclip | Clipped | Unclip | Clipped | Unclip | | Total |
| 1998 | 1.0 | 0.7 | 1.2 | 0.6 | 1.7 | 1.6 | 0.5 | 0.0 | 0.8 | 1.1 |
| 1999 | 0.3 | 0.0 | 0.5 | 0.0 | 1.3 | 0.8 | 0.7 | 1.2 | 0.7 | 0.6 |
| 2000 | 0.8 | 0.3 | 0.0 | 1.8 | 0.8 | 0.9 | 0.0 | 1.9 | 0.7 | 0.8 |
| 2001 | 3.1 | 4.2 | 2.8 | 9.8 | 9.6 | 5.9 | 8.3 | 4.6 | 13.5 | 7.7 |
| 2002 | 10.6 | 9.8 | 5.5 | 14.1 | 13.0 | 9.6 | 11.5 | 17.9 | 11.6 | 11.9 |
| 2003 | 29.2 | 17.8 | 17.7 | 22.4 | 40.0 | 33.9 | 27.3 | 21.2 | 37.2 | 26.3 |
| 2004 | 16.3 | 13.5 | 8.0 | 27.9 | 31.8 | 22.0 | 14.3 | 28.8 | 26.1 | 25.1 |
| 2005 | 14.7 | 13.2 | 9.4 | 11.0 | 22.5 | 17.5 | 14.6 | 25.7 | 10.8 | 13.9 |
| 2006 | 15.6 | 8.0 | 13.9 | 19.8 | 16.9 | 14.6 | 15.3 | 28.8 | 21.2 | 16.4 |
| 2007 | 17.0 | 14.9 | 17.7 | 26.8 | 33.3 | 29.8 | 21.8 | 29.9 | 33.6 | 26.1 |
| 2008 | 11.9 | 7.9 | 3.9 | 2.9 | 10.8 | 10.7 | 9.6 | 7.8 | 10.8 | 6.0 |
| 2009[1] | 0.2 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 0.0 | 1.2 | 0.3 | 0.2 |
| 2010[1] | 1.1 | 0.5 | 0.1 | 0.3 | 1.5 | 0.3 | 0.0 | 4.8 | 0.0 | 0.5 |

[1] Injury data collected in 2009 and 2010 included only body injuries that appeared recent enough to have occurred at LGO consistent with new protocols established in 2009.

Predation injuries were observed on 1.8% of 20,158 fish examined in the condition sample. The highest percentage of predation injuries was attributed to fish bites at 1.1%, followed by bird bites at 0.7%, and lamprey bites at less than 0.1%. Bird bites were most frequent on clipped and unclipped steelhead at 3.0% and 2.7 %, respectively, followed by clipped yearling Chinook and unclipped Coho at 0.8% each. Fish bites were observed most frequently on clipped sockeye at 8.4%, unclipped sockeye at 4.8%, clipped subyearling Chinook and unclipped Coho at 1.6% each.

Under the category “other”, fin hemorrhage was observed in 16.1% of the 20,158 fish sampled and was most frequently seen on unclipped subyearling Chinook salmon at 23.5%, clipped Coho at 16.7%, unclipped sockeye at 9.5%, clipped subyearling Chinook at 9.0 %, unclipped yearling Chinook salmon at 5.8%, and clipped yearling Chinook salmon at 3.9%. Of all the fish examined in 2010, 28.9% were observed with abnormalities from this category.

Table 15. Percent of fish examined that were injured, had predation marks or had signs of disease by species and clip with the number of fish examined at Little Goose Dam in 2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Coho | | Sockeye | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | |
| **Injuries** | | | | | | | | | | | |
| Head | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Eye | 0.5 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 0.1 |
| Operculum | 0.3 | 0.1 | 0.0 | 0.1 | 1.0 | 0.2 | 0.0 | 0.0 | 0.0 | 2.4 | 0.2 |
| Body | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Fin | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Total Injury | 1.1 | 0.5 | 0.1 | 0.3 | 1.5 | 0.3 | 0.0 | 0.0 | 0.0 | 4.8 | 0.5 |
| **Disease** | | | | | | | | | | | |
| Fungus | 0.5 | 0.2 | 0.0 | 0.2 | 1.4 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 |
| Columnaris | 0.0 | 0.0 | 0.8 | 9.3 | 0.1 | 0.0 | 0.0 | 0.0 | 8.3 | 2.4 | 5.8 |
| BKD | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Parasites | 0.4 | 0.1 | 1.1 | 0.7 | 0.4 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 |
| Deformity | 0.4 | 0.4 | 2.7 | 0.6 | 0.6 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 |
| Disease Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Disease | 1.4 | 0.7 | 4.7 | 10.8 | 2.5 | 5.6 | 0.0 | 0.0 | 8.3 | 2.4 | 7.7 |
| **Predation** | | | | | | | | | | | |
| Bird | 0.8 | 0.0 | 0.5 | 0.2 | 3.0 | 2.7 | 0.0 | 0.8 | 0.0 | 0.0 | 0.7 |
| Fish | 1.3 | 0.7 | 1.6 | 1.1 | 0.4 | 0.4 | 0.0 | 1.6 | 8.3 | 4.8 | 1.1 |
| Lamprey | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Predation | 2.1 | 0.8 | 2.2 | 1.4 | 3.4 | 3.1 | 0.0 | 2.3 | 8.3 | 4.8 | 1.8 |
| **Other Condition** | | | | | | | | | | | |
| Pop Eye | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Fin Hemorrhage | 3.9 | 5.8 | 9.0 | 23.5 | 1.7 | 2.0 | 16.7 | 3.1 | 0.0 | 9.5 | 16.1 |
| Pink Fin | 0.3 | 0.4 | 3.7 | 19.0 | 3.0 | 2.9 | 0.0 | 0.0 | 0.0 | 2.4 | 12.5 |
| Fin Discoloration | 0.0 | 0.0 | 0.1 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 |
| Eye Hemorrhage | 0.4 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Total Other | 4.7 | 6.3 | 13.0 | 43.7 | 4.9 | 4.9 | 16.7 | 3.1 | 0.0 | 11.9 | 29.4 |
| Total sample size | 2,075 | 847 | 1,583 | 12,360 | 2,210 | 895 | 6 | 128 | 12 | 42 | 20,158 |

[1] Overall disease and injury rates are less than the sum of the individual categories because some individual fish had more than one injury or disease.

## Mortality

Mortality at the JFF included fish that entered the JFF system dead as well as those that died at the facility. Mortality was recorded by location of recovery in the JFF and was divided into facility mortality (raceways and separator) and sample mortality. The combined rate of mortality (facility and sample) was 0.2%, the same as the 2009 total (Table 16). As of 2010, SMP personnel were not required by the Fish Passage Center to report on-site research mortality. Research mortality continues to be reported by the individual researchers.

Table 16. Annual total facility mortality as a percentage of total collection at LGO JFF 2006-2010.

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Total |
| 2006 | 0.2 | 0.3 | 0.4 | 0.4 | <0.1 | <0.1 | 1.5 | 2.4 | 0.1 | 0.2 |
| 2007 | <0.1 | 0.1 | 0.1 | 0.1 | <0.1 | <0.1 | 0.1 | 0.4 | <0.1 | <0.1 |
| 2008 | 0.2 | 0.2 | 0.2 | 0.3 | <0.1 | <0.1 | <0.1 | 0.6 | <0.1 | 0.1 |
| 2009 | <0.1 | 0.1 | 0.8 | 0.7 | <0.1 | <0.1 | <0.1 | 0.3 | <0.1 | 0.2 |
| 2010 | <0.1 | <0.1 | 0.8 | 0.7 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.2 |

Note: Mortality rate for collected fish includes sample, raceway, and separator mortalities.

Spring runoff occurred during June creating a two week period of high outflow. From June 5 through June 16 debris blockages in orifices increased mortality to a total of 5,342 smolts; of which 97% were subyearling fall Chinook, 2% were yearling Chinook, and 1% were steelhead. The mortality rate during this 11 day period was 0.7% of the collection total for that period. The season total of facility mortalities was 6,670, of which 80.1% occurred during the two week runoff period. During this time USACE staff increased debris removal efforts by performing round the clock orifice rotation and back-flushing, gatewell debris dipping, and trash rack raking.

The average weekly total facility mortality rate in 2010 ranged from 0.0% to 8.3% (Table 17). The minimum rate of 0.0% occurred frequently during the months of April and May when flows were below average with very little debris and the mortalities that occurred represented a small proportion of the total collection. High mortality rates occurred late in the collection season when total collection was very low and disease rates were high. The maximum weekly mortality rate of 8.3 % occurred during the week ending October 21, when the total weekly collection was 533 fish of which 36.3 % had symptoms of presumed columnaris. As total mortality rates were skewed, median season mortality rates were determined for each species group/clip type and also for a combined total (Table 17). The median season total facility mortality rate for all smolts was 0.9%.

Mortality that occurred in the sample tanks was included in the daily sample number which was expanded to determine the collection number. Sample mortality for the 2010 season remained unchanged from the rate reported in 2009 at 0.8% (Table 18). Sample mortality was highest for the months of August with 1.1% mortality from 9,651 sampled, September with a peak rate of 2.9% of 615 sampled, and October with 2.6% of 5,447 sampled. This trend coincided with increased water temperatures and an increase in columnaris infection within the salmonid sample population.

Table 17. Weekly total facility mortality in percent at Little Goose Dam JFF, 2010

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| Week Ending | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Total |
| 1-Apr | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 8-Apr | ----- | 0.0 | ----- | ----- | 0.0 | 0.0 | ----- | ----- | ----- | 0.0 |
| 15-Apr | 7.7 | 0.0 | ----- | ----- | 0.0 | 0.0 | ----- | ----- | ----- | 0.9 |
| 22-Apr | 2.4 | 0.0 | ----- | ----- | 0.0 | 0.0 | ----- | ----- | ----- | 0.7 |
| 29-Apr | 0.0 | 0.0 | ----- | ----- | 0.0 | 0.0 | ----- | ----- | ----- | 0.0 |
| 6-May | 0.0 | 0.0 | ----- | ----- | 0.0 | 0.0 | ----- | ----- | 0.0 | 0.0 |
| 13-May | 0.0 | 0.0 | ----- | 2.0 | 0.0 | 0.0 | ----- | ----- | 0.0 | 0.0 |
| 20-May | 0.0 | 0.0 | ----- | ----- | 0.0 | 0.0 | ----- | 0.0 | 0.0 | 0.0 |
| 27-May | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | ----- | 0.0 | 0.0 | 0.0 |
| 3-Jun | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| 10-Jun | 0.5 | 0.2 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 |
| 17-Jun | 0.1 | 0.0 | 1.2 | 1.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 1.0 |
| 24-Jun | 0.2 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 4.0 | 0.0 | 0.0 | 0.1 |
| 1-Jul | 0.0 | 1.8 | 0.1 | 0.1 | 0.0 | 0.2 | ----- | 0.0 | 0.0 | 0.1 |
| 8-Jul | 0.0 | 0.0 | 0.2 | 0.1 | 0.3 | 0.5 | ----- | 0.0 | 0.0 | 0.1 |
| 15-Jul | ----- | 10.0 | 0.7 | 0.2 | 0.0 | 0.0 | ----- | 0.0 | 0.0 | 0.3 |
| 22-Jul | 0.0 | 14.3 | 0.9 | 0.5 | 5.3 | 0.0 | ----- | 0.0 | ----- | 0.5 |
| 29-Jul | 0.0 | 14.3 | 1.4 | 0.5 | 0.0 | 11.1 | ----- | ----- | 0.0 | 0.6 |
| 5-Aug | 0.0 | ----- | 0.9 | 0.9 | ----- | 33.3 | ----- | 50.0 | 0.0 | 0.9 |
| 12-Aug | 0.0 | ----- | 1.5 | 1.5 | 0.0 | 0.0 | ----- | 0.0 | ----- | 1.5 |
| 19-Aug | 0.0 | ----- | 1.8 | 1.2 | 33.3 | 3.3 | ----- | ----- | 20.0 | 1.2 |
| 26-Aug | 20.0 | 0.0 | 25.0 | 1.6 | ----- | 0.0 | ----- | ----- | 0.0 | 1.7 |
| 2-Sep | 0.0 | 0.0 | 0.0 | 1.9 | ----- | 0.0 | ----- | 0.0 | 0.0 | 1.9 |
| 9-Sep | ----- | ----- | 0.0 | 4.1 | 0.0 | 0.0 | ----- | 0.0 | 0.0 | 3.8 |
| 16-Sep | 0.0 | ----- | 0.0 | 3.7 | 0.0 | 0.0 | ----- | ----- | 0.0 | 3.5 |
| 23-Sep | 0.0 | ----- | 0.0 | 4.6 | ----- | 0.0 | ----- | 0.0 | 0.0 | 4.3 |
| 30-Sep | ----- | ----- | 0.0 | 1.5 | ----- | ----- | ----- | ----- | 0.0 | 1.5 |
| 7-Oct | 0.0 | 0.0 | 0.0 | 2.0 | ----- | 0.0 | ----- | 0.0 | 0.0 | 1.9 |
| 14-Oct | ----- | ----- | 28.6 | 5.6 | ----- | ----- | 0.0 | ----- | 0.0 | 5.8 |
| 21-Oct | 50.0 | ----- | 0.0 | 8.2 | ----- | ----- | ----- | ----- | ----- | 8.3 |
| 28-Oct | ----- | 0.0 | 12.5 | 3.5 | ----- | 0.0 | ----- | ----- | ----- | 3.5 |
| 4-Nov | ----- | 0.0 | 0.0 | 3.9 | ----- | ----- | ----- | 0.0 | 0.0 | 3.9 |
| Median Wkly Mortality Rate | 0.01 | 0.0 | 0.2 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 |

Note "---" indicates that the species group was not present in the sample during the week.

Table 18. Annual sample mortality as percent of total sample at Little Goose Dam JFF, 2006-2010

| | Yearling Chinook | | Subyearling Chinook | | Steelhead | | Sockeye | | Coho | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Clip | Unclip | Clip | Unclip | Clip | Unclip | Clip | Unclip | | Total |
| 2006 | 0.9 | 0.6 | 0.5 | 0.5 | 0.1 | <0.1 | 2.4 | 5.5 | 0.1 | 0.5 |
| 2007 | 0.2 | 0.4 | 0.2 | 0.4 | 0.3 | 0.3 | 1.3 | 2.9 | 2.2 | 0.4 |
| 2008 | 0.2 | 0.6 | 0.4 | 0.5 | 0.1 | 0.1 | 1.9 | 3.6 | 0.2 | 0.4 |
| 2009 | 0.4 | 0.4 | 1.0 | 1.1 | 0.1 | 0.2 | 0.0 | 2.8 | 2.7 | 0.8 |
| 2010 | 0.5 | 0.3 | 0.5 | 1.0 | <0.1 | 0.2 | 0.0 | 1.2 | 0.6 | 0.8 |

Note: Mortality rate in sampled fish; excludes research, raceway, and separator mortalities. Includes GBT sample fish

## Research and Monitoring

ODFW and USACE personnel provide various types of research and monitoring assistance during the fish passage season. Typically, ODFW provides research specimens that are collected on site via the sample. The summaries below describe each research project.

### Gas Bubble Trauma Monitoring

Biological technicians from the Washington Department of Fish and Wildlife (WDFW) examined juvenile salmonids for the presence of gas bubble trauma (GBT). When fish numbers permitted, a maximum of 100 fish were sampled. Sampling occurred weekly, on Mondays, from April 11 to August 30, 2010. Sampling was designed to determine the relative proportion of migrating juvenile salmonids passing the dam that exhibited symptoms of GBT in the unpaired fins and eye.

A total of 1,606 smolts were examined for GBT in 2010. Of the fish examined, 47.2% were subyearling Chinook salmon, 32.1% were steelhead and 20.7% were yearling Chinook salmon. The total GBT rate for the 2010 season was 1.8%, a substantial increase from last year's rate of 0.2%. Unclipped smolts comprised 54.1% of the total sample with a trauma rate of 2.0% from 869 examined compared to clipped smolts which made up 45.9% of the total sample with a trauma rate of 1.6% from 737 examined. The trend observed in recent years continued in 2010 with the GBT rate highest in steelhead (2.3%), followed by subyearling Chinook (2.0%), and yearling Chinook (0.6%). Trauma observations increased in late May through mid June, with the peak trauma rate occurring June 16 at 15.0% from 100 fish examined, corresponding to the dates of highest outflow when gas saturation levels were highest. Individual signs of injury totaled 37 with the majority of injuries occurring in the first and second week of June. Most injury was observed in the caudal fin and totaled 20 individual signs followed by nine signs in the dorsal fin, seven in the anal fin, and one sign in the eye. Some fish were observed with trauma in multiple regions of the body. In terms of trauma severity, a total of 26 signs were given a rank of 1 (1-5% bubble coverage of body region), five signs of a rank 2 (6-25% coverage), five signs of a rank 3 (26-50% coverage) and one rank of a 4 (>50%). The overall mortality rate for the season was low at 0.2% of the fish examined.

### Salmonid Riverine Survival

The separation by code diversion tank located at the JFF was utilized by NOAA Fisheries personnel for the tenth consecutive season. The study targeted PIT tagged wild Snake River spring/summer Chinook salmon smolts by diverting them into a holding tank where they were anesthetized, measured, and weighed by NOAA personnel. NOAA data collection continued to aid in establishing baseline information on natal stream productivity and the relationship between growth rates and parr-to-smolt survival. All fish were released back to the river upon recovery. On-site activity occurred from May 3 through June 29, 2010.

A total of 1,248 salmonids were diverted and handled during the sampling period. During periods of high fish passage it became impossible to separate tagged fish from untagged

fish during diversion. In addition, an increase in the number of untagged fish diverted can coincide with operations to remove debris from the separator. In 2010, untagged bycatch totaled 57.8% of the total catch compared to tagged fish at a rate of 42.0% with similar results occurring in previous years. Species composition of PIT tagged fish was dominated by unclipped yearling Chinook salmon (91.8%) followed by clipped steelhead (4.0%), clipped yearling Chinook (2.3%), clipped subyearling Chinook (1.5%) and unclipped steelhead (0.6%). Total mortality on all diverted fish was 0.1 %.

Habitat Usage in the Lower Snake River Reservoirs by Juvenile Fall Chinook Salmon

The USGS and USFWS conducted a cooperative study entitled "Use of Shallow Water Habitats in Lower Snake River Reservoirs by Juvenile Fall Chinook". Specifically, the study will evaluate river environments being considered for dredge material disposal by the USACE. Study objectives are 1) to compare estimates of juvenile fall Chinook salmon density among different shallow water habitats and 2) compare estimates of the residence times of juvenile fall Chinook salmon among different shallow water habitats. Fish collection and tagging for this study occurred via seine, angling, and from SMP samples.

At Little Goose Dam Juvenile Fish Facility, researchers requested 200 juvenile fall Chinook, at least 170mm in fork length, from the sample. Radio and PIT tagging occurred on site. Fish were tagged on the same day as collection with release into the tailrace occurring the same day that the fish were tagged. From October 22 through October 26, we collected and bypassed a total of 257 subyearling fall Chinook salmon to researchers; 3 were clipped and 254 were adipose intact. Reservoir monitoring of the fish is being conducted once a week and is scheduled to continue through mid May 2011.

Bull Trout Studies (USFWS)

Biologists with the United States Fish and Wildlife Service (USFWS) conducted a study on bull trout, *Salvelinus confluentus,* entitled "Monitor Subadult and Adult Bull Trout Passage Through Lower Granite, Little Goose and Lower Monumental Juvenile Bypass Facilities". Study objectives focused on the presence, timing and use of the main stem Snake River as a migratory corridor by bull trout originating from the Tucannon River. In addition, researchers used genetic assignments to identify distinct populations of bull trout that use and overwinter in the Federal Columbia River Power Systems (FCRPS).

USFWS requested that the lower Snake River SMP personnel obtain tissue samples, collect morphometric data, and PIT tag bull trout entering the fish facilities. No more than five bull trout from each facility were allowed to be handled. Also, fish handling ceased when river temperatures reached or exceeded 59.0$^{o}$F. In 2010 we handled and tagged a total of three bull trout, all collected from the separator. Per USFWS tagging protocols, all fish were PIT tagged in the dorsal sinus. Average size of the fish was 373mm with ranges of 345mm to 395mm. All fish appeared in excellent health and were released into the tailrace upon recovery from anesthesia.

All three fish were detected exiting the facility. One fish was detected six days later at Lower Granite's adult ladder exit.

Miscellaneous Monitoring

As in previous years, the USACE and ODFW SMP personnel at the Little Goose JFF continued to monitor collections and the facility for zebra mussel *Dreissena polymorpha*. The zebra mussel monitor is a piece of substrate suspended in the adult fish ladder near the ladder exit. No zebra mussels were observed during the 2010 monitoring period.

Siberian prawn, and Amur goby *Rhinogobius brunneus* also continued to be monitored in 2010. The sample was screened on a daily basis for Siberian prawn and Amur goby and a count of live and dead individuals were made. Siberian prawns were observed in the sample as early as April 5 and found consistently in the sample from July 1 through October 31. At the request of the Washington Department of Fish and Wildlife in 2005, we continued to dispatch all prawn in 2010. Euthanasia was by freezing and all frozen prawns were returned to the river. While monitoring for the Amur goby began in 2006, we have yet to observe any at the JFF.

## Facility Operations & Maintenance

Forebay Debris/Trashracks

Estimates of debris volume and location in the forebay were recorded daily during JFF inspections. Large accumulations of woody debris were present in the Little Goose forebay beginning June 7 and extending until mid July. The maximum debris estimate was reported on June 14 and consisted of 32,500 square feet of debris in the forebay. As in past years, debris caused the majority of smolt injury and mortality. The debris was removed by opening spillbays, trash rack raking, gatewell debris dipping, separator debris cleanouts, and increased orifice rotations. In addition, debris exited the forebay via the SW located in spillbay one in 2010.

Debris entered into the immediate forebay area and turbine intakes as follows. Waterlogged submerged debris entered by passing under the trash-shear and log booms. Floating debris entered when winds pushed debris over the log boom and/or through the log boom boat access opening. Debris also collected along the trash-shear boom and was held in place and pulled under the boom by the entrained water for turbine operations. Lastly, floating debris entered through the new open frame system that connects the trash-shear boom to pier nose located between turbine unit 6 and spillway 1. The new SW, installed in 2009, required the trash-shear boom point of connection to be moved from the pier nose between spillway 1 and 2 to the concrete face between turbine unit 6 and spillway 1. The new connection uses an open frame designed with the intent to let debris move out from in front of the turbine unit intakes to spillway one to be spilled when using the SW. The opposite occurred when 5 to 6 turbine units were in operations. The entrained water for turbine operations overpowered the spillway/SW flow forces. In 2010, a make shift debris stop consisting of a large log was attached to the

spillway side of trash/shear boom attachment frame. The log acted as a one way valve that prevented debris in the spillway section from entering the powerhouse intake section. Debris would then flow over the SW and into the tailrace.

At the conclusion of MOP when forebay elevations were increased, debris floated from the banks and accumulated in the forebay. No blockages were reported during this latter time.

Spillway Weir

The spillway weir (SW) was installed in 2009 in spillway one to provide a surface passage route for downstream juvenile salmonid in-river passage. The weir is a vertically shortened bulkhead installed in the bulkhead slot of spillway 1 and becomes operational when the spillway tainter gate is fully raised. Water spills over the TSW in a waterfall or plunge fashion intersecting with downstream slope approximately 80 feet below. The SW has two operating heights, low crest (618 ft. msl) which discharges approximately 6.7 kcfs spill at full pool and high crest (622 ft. msl) which discharges approximately 10.7 kcfs spill at full pool. Low crest is designed to operate during high flows (> 75 kcfs) and high numbers of juvenile fish migrating downstream. High crest is designed to operated during low flows (<75 kcfs) and low numbers of fish passage. The crest height is controlled using two different bulkheads which require the use of the 100 ton gantry crane and a 5 person mechanical crew (20 man hours) to remove and/or install.

Also in 2009, a new design spillway deflector was installed on spillway one downstream slope approximately 7-10 feet below the tailwater surface elevation. The new deflector has a convex shape that guides the water to ride up toward the surface preventing a deep plunge thus reducing gas super saturation. The SW surface passage route combined with reduced gas saturation reduces fish gas bubble trauma disease.

The SW was again used in spillway one in 2010 and placed into operation on April 3 in the high crest position. The weir height was changed on May 13 to the low crest position. The SW was removed from operations May 18 at 0800 hours to May 20 at 1120 hours due to low numbers of adult fish moving upstream in the adult fish ladder. The idea was that the SW spill was producing adverse tailrace water conditions that reduced adult fish guidance into the adult fishway. Upon closure, an increase in adult fish numbers was immediately observed. On May 25 at 0800 hours, the SW was again removed from service to allow improved tailrace conditions for adult fish passage into the collection system and ladder fishway. Again, an observed increase in adult fish passage was immediately observed. The SW was returned to service on May 27 at 1520 hours in the high crest mode and continued to operate until August 5 at 0822 hours when it was removed from service for the remainder of the year.

Turbine Operation

Efforts were made to operate all turbine units within 1% limitation of best efficiency from April 1 to October 31. Best efficiency operations provide greatest fish passage survival through operating turbines. Reportable deviations consist of operations outside the 1% criteria

for more than 15 minutes in duration and/or 5 or more periods of at least 5 minutes during a single calendar day. In 2010, all units were operated within the best efficiency range. There were no reportable deviations.

Drawdown inspections across trashracks and ESBS/VBS were performed according to the FPP. Heavy debris loading occurred with the high flows in June however the debris did not interfere with turbine operations. All drawdown inspection measurements were within criteria throughout the season. Debris removal using the trash rack rake occurred in 2010 but at a reduced rate due to mechanical problems. A large pile of debris remains entangled on turbine unit one trash rack which can not be removed with the rake. A dive team is scheduled to assist with the removal of this debris in the winter maintenance period of 2011.

During the 2010 fish passage season, scheduled and unscheduled turbine outages lasting longer than 24 hours are listed in Table 19. There were several other scheduled and unscheduled outages that lasted less than 24 hours. These outages supported short term repairs, inspections, trash rack raking, fish screen repairs and to install and remove fish screens before and after the fish passage season.

Table 19. 2010 Turbine Unit Outages greater than 24 hours (April 1 to December 15).

| | | | |
|---|---|---|---|
| Units One - Three | Scheduled | 3 Aug. – 13 Aug | Main Transformer (T-1) Repairs |
| Unit One | Scheduled | 16 Aug. – 7 Sep. | Annual Inspection / Maintenance |
| Unit Two | Unscheduled | 01 Apr. – 11 Jun. | Repair Oil Thrust Pump |
| Unit Two | Scheduled | 07 Sep. – 23 Sep. | Annual Inspection / Maintenance |
| Unit Three | Unscheduled | 23 Apr. – 27 Apr | Repair Fish Screens |
| Unit Three | Scheduled | 27 Jul. – 13 Aug. | Annual Inspection / Maintenance |
| Unit Three | Unscheduled | 19 Oct. – 20 Oct. | Co2 Discharge |
| Unit Four | Scheduled | 26 Jul. – 13 Aug. | Annual Inspection / Maintenance |
| Unit Five | Unscheduled | 24 Apr. – 27Apr. | Repair Maintenance, Gate lock |
| Unit Five | Unscheduled | 12 Jun. – 15 Jun. | Repair Maintenance, Field Ground |
| Unit Five | Scheduled | 06 Jul. – 21 Jul. | Annual Inspection / Maintenance |
| Unit Five | Scheduled | 25 Oct. – 27 Oct. | Inspection Maintenance |
| Unit Six | Unscheduled | 01 Apr. – 05 Apr. | Fish Screens not installed |
| Unit Six | Scheduled | 18 Oct. – 24 Nov. | 6 - year overhaul / Maintenance |

In recent years, it has become evident that juvenile fish were being trapped in cooling water strainers. Beginning in March 2010, turbine unit cooling water strainers were checked weekly for juvenile fish entrapment. The cooling water is originates from an inlet located in the scrollcase. The grating covering the inlet has open spaces large enough to allow small fish to pass through and thus getting entrapped into the strainer. In 2010 there were a total of 212 juvenile lamprey and 4 salmonid smolts, all mortalities collected from the strainers. Most of the fish, 171 or 80.7% were collected in the month of June simultaneously with the spring freshet.

Extended-Length Submersible Bar Screens (ESBS)

Initial drawdown measurements were conducted on April 1, and weekly thereafter through June, every two weeks from July through October. All drawdown measurements met criteria.

There were two ESBS failures that required forced outages of turbine units 5 April 1 to 16. There were an additional 24 ESBS outages due to tripped circuit breakers. All were short in duration and required resetting the breakers. Overall ESBS failures doubled that recorded in 2008.

Underwater camera inspections were performed on ESBS 1A – 4C on April 26 -28. The underwater camera failed on April 28. Using a borrowed camera from Ice Harbor video inspections of ESBS 2A – 6C were performed on June 29 – 30. This camera also failed on June 30 preventing the inspection of ESBS 1A – 1C. During the video inspections ESBS were observed to be in good operating condition and clear of debris. The malfunctioning of the camera prevented video inspections for the remainder of the fish passage season. To compensate for the lack of video inspections, ESBS brush motors were manually operated using the PLC. All indicators (amperage, brush travel distance) were observed to verify proper operation.

ESBS cleaning brushes were programmed to automatically operate at two hour intervals in 2010. This frequency of cleaning brush operations reduced the amount of debris collected on the screens between brush cycles. This in turn, reduced debris swept up into the gatewell during each brush cycle and thereby helped to reduce orifices blockages.

Vertical Barrier Screens (VBS)

Scheduled inspections of the VBS were performed by underwater video camera concurrently with ESBS inspections. Thorough VBS inspections of screens 1A -1C, 4A- 4C and 6A- 6C were performed on December 13. All inspections showed VBS in good operating condition.

Gatewells

Gatewells were checked for debris and oil contamination daily. As needed, debris was removed using a dip basket or grappling hook. As in most years, small traces of oil were occasionally observed in gatewells during the season. The oil contamination was attributed to rain-washed drippings from vehicles and mechanical equipment which accumulated on intake deck or gatewell walls. In 2010, observation of oil traces were less than those in previous years.

Orifices and Collection Channel

The juvenile collection channel and flume were placed into service March 24. Open orifices were increased from 18 to 21 on March 30. The collection channel was operated throughout the season with 20 to 23 open orifices depending on forebay elevations. Minimum operating pool (633.0 feet msl) plus 1' elevation (MOP +1) occurred from April 1 through September 3.

Orifices were inspected and/or back-flushed at least once per shift from April 1 through May 22. Beginning May 23 and continuing through June 29 orifices inspections and back-flushing were increased in frequency in response to debris loading. Full-time night shifts were added to the schedule solely to operate and back-flush orifices to clear and prevent debris blockages.

All orifice operations (opening, closing, backflushing) were manually performed throughout the year. The orifices, collection channel, dewatering structure and flume were taken out of service for winter maintenance on December 16.

Primary Dewaterer

Overall, the primary dewatering structure functioned adequately throughout the season. In January through March 2010 contractors completed construction of the new excess water downwell, downwell spillway, underground plumbing to the pump chamber and tailrace, two new 42" valves and valve operators, and an access platform to service valves. All components operated satisfactorily throughout the season. Excess water was diverted to the adult fish channel pump chamber the entire season to help supplement flows for adult fish migration.

Flume

The primary bypass flume functioned satisfactorily in 2010. During winter maintenance 2010, the primary bypass outfall flume was relocated from near shore to mid channel. The relocation extended the release site approximately 400 feet towards the mid-channel. This new section of outfall is made of 36 inch corrugated metal pipe. The new point of release will allow bypassed fish to migrate downstream with less delay. The old point of release was located close to shore and further upstream where bypassed smolts were likely to be entrained into a back current eddy slowing downriver out migration. The flume was inspected during the winter maintenance period 2011 and observed in good condition and found free of obstructions and rough edges.

Separator

The separator was operated in a similar fashion as previous years. The water level was kept about 1 to 2 inches above the downstream ends of the A-side separator bars. At times the

water level was lowered to force fish to pass through the bars. Heavy accumulations of debris occurred in the separator in June which prompted the facility to clean the separator on June 30. The facility was switched to primary bypass operations for 1 hour to clean debris from the separator. During debris removal, large numbers of ammocoete lamprey were salvaged and released to the river. During the winter maintenance period, the interior and exterior surfaces of the separator were cleaned and/or refurbished.

Sample System/PIT Tag System

The PIT tag detection and diversion systems at the lower Snake and Columbia River dams are maintained and operated by the Pacific States Marine Fisheries Commission. PIT tagged salmonids have been monitored for movement and behavior in the Columbia and Snake Rivers since 1987. At Little Goose Dam, there are 11 PIT tag monitors located throughout the JFF. A new "full flow" unit that monitors the main channel of the juvenile flume upstream from the JFF was added in 2009. Upon the completion of construction and winter maintenance operations, the full flow unit was brought into service for the first time March 23, 2010.

The state of the Divert During Sample (DDS) system was manually changed by project biologists and technicians based upon sample rates. In order to avoid biasing the sample, the PIT tag DDS slide gates were set in the "off" position or deactivated during sampling events when fish passage was high and sample rates low (≤20%). At this deactivated setting, any PIT tagged fish directly destined for other routes such as the NOAA Sort by Code system, transport or bypass, were instead routed into the sample during sampling events. At sample rates greater than or equal to 20%, (low numbers of fish passing through system), the DDS system was set to "on" or activated. With the DDS on, any PIT tagged fish destined for the Sort by Code system, transport or bypass were diverted to these destinations during sampling events. As in previous years, state changes o the DDS system were automatically logged and were documented on the PTAGIS website www.ptoccentral.org.

Direct Barge Loading Operations/Transportation

In 2010, daily barging and direct loading operations occurred on May 1 - 2 and May 3 through May 28, alternate day barging occurred from May 30 to August 16 and alternate day trucking occurred from August 16 to October 31. The loading boom and fish routing pipes and flumes performed satisfactorily. Barged fish were transported to a release point at mid-channel below Bonneville Dam.

The 3,500 gallon tanker semi-tractor combination assigned to LGO was not used in 2010. All truck transportation was performed using the one ton truck and 300-gallon midi-tank except on October 3 and 5 when fish collection exceeded the 300 gallon limit. On October 3, LGR trucked a portion of the fish collected and on October 5, LGR trucked all the fish collected using their 3,500 gallon tanker. Salt in small concentrations of approximately 1 g/L is added to the midi-tank water to treat potential Columnaris disease and reduce stress. In 2010 trucked fish were again released into the outfall fish flume located at the juvenile fish facility downstream of

Bonneville dam. A total of 10,667 fish were trucked from LGO. Of these, there were 10 fish (sub-yearling Chinook) that resulted in mortalities. All the mortalities were the result of disease (presumed Columnaris).

Avian Predation

Springtime gull predation on juvenile salmon and steelhead at Little Goose has been significantly reduced since 1999 when the USDA Animal and Plant Health Inspection Service (APHIS) began bird hazing activities. Prior to 1999, 150 to 200 birds were continuously observed in the tailrace area for several weeks from late April to mid-June, during the peak of the smolt migration season. On some days, up to 300 to 400 gulls were observed roosting on the North Shore riprap. Since 1999, these numbers have been significantly reduced due to bird hazing activities.

In 2010, bird hazing activities at Little Goose took place from April 11 through June 19. Gulls (*Larus spp.*) were observed throughout the entire year with the peak period recorded between April 30 and May 24. This peak period occurred similar to 2009. During the peak period, daily observations ranged between 25 and 150 gulls. Beginning in late September and continuing through November in response to juvenile shad out migration, gull populations again increased with a maximum 50 gulls observed on October 27. On average gull numbers were lower than that observed in previous years during this time of year.

Double Crested Cormorants (*Phalacrocorax auritus)* numbers continued to be lower in 2010 similar to 2009 and much lower than that observed in previous years. Cormorants were observed throughout the early juvenile fish migration season but their numbers were usually less than 10. The peak period for Cormorants occurred September through November also in response to juvenile shad out migration. During the peak period, up to 30 Cormorants were observed during a single sighting (October 27). The majority of the birds were counted within the area one half mile upstream and downstream of the dam. These numbers are far less than the 100 to 200 observed during the previous years (2005-2008) during the same period. The decline in 2009 and 2010 may be the result of lethal take for research purposes. Approximately 45 Cormorants were taken in the fall/winter of 2007-08 and 2008-09.

American White Pelicans (*Pelecanus erythrorhynchos*) sighting and numbers have increased over 2007 – 2009. In 2010, Pelican observations and numbers were less than that observed in 2009. One to six pelicans were observed in single sightings in the tailrace area in early May through early June.

Other piscivorous bird species observed during the 2010 season include Western Grebes (*Aechmophorus occidentalis*) and Caspian Terns (*Sterna caspia*).

A summary of actions taken by the Corps to reduce avian predation at Little Goose as follows:

1. Fifteen bird wires were installed over the tailrace area below the powerhouse, thirteen in 1992, one each in 2007 and 2008. Additionally, one bird wire was replaced in 2008. Gulls

avoid flying under the wires. Since 1992, proposals have been made to have wires strung below the spillway as well. However, this was not presently feasible due to the lack of an existing structure to which wires could be attached. Bird wires effectively deter gulls, as they tend to locate prey from above. In the case of cormorants, bird wires do not appear to be effective as they approach prey at or below water level.

2. The two 10" bypass pipes were rerouted to swifter water in the middle of the river in 1997. The pipes and much of the support structure are outfitted with needle strips to prevent gulls from perching. The primary bypass flume/pipe was rerouted to this site in 2010. It too was outfitted with needle strips to prevent gulls from perching.
3. A large "sprinkler" is located at the outfall of the bypass flume and pipes. The sprinkler interferes with gull flight patterns, except in high winds.
4. A propane bird scare cannon was successfully utilized in the tailrace to help haze away birds in 2008. A second cannon was purchased in 2008 however, only one cannon was used at a time. The cannon proved to be effective for short-term dispersal of piscivorous birds.
5. The U.S. Department of Agriculture, under contract with the Corps, provided an animal control specialist to work at Little Goose (and Lower Granite) from 1999 to 2002. An animal control specialist has been solely assigned to Little Goose during weekdays from 2003 – 2007. Beginning in 2007 specialists performed hazing activities seven days a week. It is anticipated that similar work will continue well into the future.
6. The upstream 200 feet of the vertical wall of the trash-shear boom located in the forebay was outfitted with needle strips in 2008. The needle strips prevented gulls and cormorants from perching along the top of the wall.
7. The Corps continues to sponsor research to determine best methods to deter prey on salmonid smolts and juvenile Lamprey.

## Recommendations

- Inspect and service the trash-shear boom hold down cables.
- Reposition the trash-shear boom to extend it further upstream removing some of the slack created when it was repositioned in March 2009.
- Install a new log boom with removable closure over the boat access opening.
- Re-lamp the outdoor lighting around the collection facility.
- Prepare and paint the exterior surfaces of pipes and framework of the JFF.

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The Little Goose Dam JFF was managed, operated, and maintained during 2010 by the following people:

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**(Appendix Tables)**